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Occurrence of *Chlamydiaceae* in raptors and crows

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1. Summary

1.1 Summary

Members of the *Chlamydiaceae* family are globally distributed and are able to infect numerous bird species. Several studies found *Chlamydia* species that were genetically intermediate between *C. psittaci* and *C. abortus*. One of these intermediates was recently described as *C. buteonis*.
In the first part choanal, cloacal and fecal swabs from Swiss raptors and corvids were investigated. In total, 1128 samples from 341 raptors and 253 corvids were included. *Chlamydiaceae* were detected in 23.7% of the corvids and 5.9% of the raptors. In corvids, the most frequently detected *Chlamydia* species was *C. psittaci* outer membrane protein A (*ompA*) genotype 1V. Moreover, *C. psittaci* 6N and *C. psittaci* D were detected in corvids. The most frequently detected *Chlamydia* species in raptors was *C. psittaci* M56. Other *C. psittaci* genotypes detected in raptors included 1V and A.
In the second part fecal samples from 23 falcons and three pigeons from the Arabian Peninsula were investigated. The clinical history was known for eight falcons, six of them showing clinical signs compatible with avian chlamydiosis. The samples were investigated using a step-wise approach, including a *C. buteonis*-specific real-time PCR. Sixteen falcons were positive for *C. buteonis* while all three pigeons harbored *C. psittaci*. This is the first time that *C. buteonis* was detected in members of the Falconidae family and on the Arabian Peninsula. The results of this study indicate that *C. buteonis* is pathogenic for falcons.

Keywords: *Chlamydiaceae*, raptor, crow, *C. psittaci*/*C. abortus* intermediates, *C. buteonis*

1.2 Zusammenfassung

Bakterien der Familie *Chlamydiaceae* kommen weltweit vor und können eine Vielzahl verschiedener Vogelspezies befallen. Mehrere Studien fanden Chlamydien-Spezies, die genetisch intermediär zwischen *C. psittaci* und *C. abortus* sind. Eine dieser Spezies wurde kürzlich als *C. buteonis* beschrieben.
Im ersten Teil wurden Choanen-, Kloaken- und Kottupfer von Greif- und Rabenvögeln aus der Schweiz untersucht. Insgesamt wurden 1128 Proben von 341 Greifvögeln und 253 Rabenvögeln untersucht. *Chlamydiaceae* wurden bei 23.7% der Rabenvögel und 5.9% der Greifvögel nachgewiesen. Bei Rabenvögeln war die am häufigsten nachgewiesene Chlamydien-Spezies *C. psittaci* outer membrane protein A (*ompA*) Genotyp 1V. Weiter wurden *C. psittaci* Genotyp 6N und D gefunden. Die häufigste Chlamydien-Spezies bei Greifvögeln war *C. psittaci* M56. Weiter wurden die Genotypen 1V und A nachgewiesen.
Im zweiten Teil wurden Kotproben von 23 Falken und drei Tauben von der Arabischen Halbinsel untersucht. Die klinische Vorgeschichte war von acht Falken bekannt, sechs davon zeigten klinische Anzeichen. Die Proben wurden mit einem schrittweisen Ansatz untersucht, einschliesslich einer *C. buteonis*-spezifischen real-time PCR. Bei 16 Falken wurde *C. buteonis* nachgewiesen. Alle drei Tauben waren positiv für *C. psittaci*. Im Rahmen dieser Arbeit wurde das erste Mal *C. buteonis* in Falken und auf der Arabischen Halbinsel nachgewiesen. Die Resultate deuten darauf hin, dass *C. buteonis* bei Falken klinische Zeichen auslösen kann.

Stichworte: *Chlamydiaceae*, Greifvögel, Krähen, *C. psittaci*/*C. abortus* Intermediäre, *C. buteonis*

2. Introduction

Members of the *Chlamydiaceae* family are gram-negative, obligate intracellular bacteria characterized by their unique biphasic lifecycle (Sachse et al. 2015). The *Chlamydiaceae* family currently comprises a single genus, *Chlamydia*, including 14 species, namely *Chlamydia* (*C.) psittaci, C. abortus*, *C. avium*, *C. felis, C. gallinacea*, *C. muridarum, C. pecorum, C. suis, C. caviae, C. pneumoniae, C. buteonis, C. serpentis, C. poikilothermis*, and *C. trachomatis*, as well as the three candidate species *Candidatus* (*Ca.)* C. ibidis*, Ca.* C. corallus, and *Ca.* C. sanzinia (Cheong et al. 2019; Laroucau et al. 2019). *Chlamydiaceae* are globally distributed and have a broad host range including humans, mammals, birds, reptiles, and amphibians (Cheong et al. 2019). *C. psittaci,* the most well-known chlamydial species harbored by birds, has been reported to infect more than 460 avian species spanning at least 30 orders (Kaleta and Taday 2003). Wild birds serve as an important reservoir not only for *C. psittaci*, but also for several other chlamydial species. To date, *C. psittaci*, *C. abortus, C. avium, C. gallinacea, C. pecorum, C. buteonis, C. trachomatis, C. suis, C. pneumoniae, C. muridarum,* and *Ca.* C. ibidis have been detected in birds (Sachse et al. 2012; Vorimore et al. 2013; Di Francesco et al. 2015; Guo et al. 2016; Szymańska-Czerwińska et al. 2017; Laroucau et al. 2019; Stokes et al. 2019).

Avian chlamydiosis caused by *C. psittaci* is a notifiable disease in Switzerland. Between 2010 and 2019, 46 cases were reported to the Federal Food Safety and Veterinary Office, of which 35 cases were in domestic and eleven in wild birds (Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV) 2020). The clinical signs in infected birds are variable, depending on the virulence of the strain, the susceptibility of the host species, and the immune status of the individual, but are mostly characterized by respiratory, ocular, and enteric signs, while asymptomatic infections are also common (Sachse et al. 2015; Borel et al. 2018). Shedding of the bacteria occurs in both diseased birds and asymptomatic carriers and can be intermittently activated by stressful events like migration, breeding or other illnesses (Knittler et al. 2015).

The zoonotic risk of *C. psittaci* and *C. abortus* is well-known, while for other members of the *Chlamydiaceae* family found in birds, further research must evaluate their zoonotic potential (Cheong et al. 2019). Transmission of *C. psittaci* between birds or from birds to humans occurs through inhalation of feather dust and contaminated aerosols from urine, feces, respiratory or eye secretions (Beeckman and Vanrompay 2009). Therefore, close or frequent contact with diseased birds or asymptomatic carriers poses a risk for human health. Human to human transmission of *C. psittaci* is possible but is believed to be rare (Wallensten et al. 2014). In contrast to avian chlamydiosis, zoonotic *C. psittaci* infections in humans (also called psittacosis or ornithosis if acquired from non-psittacine birds) are no longer notifiable in Switzerland. From 1941 to 2003, however, 78 cases were reported in humans in Switzerland (Haag-Wackernagel 2006). In humans, *C. psittaci* infection causes a range of symptoms: some individuals remain asymptomatic or have a mild flu-like infection while others can develop a serious, in rare cases even life-threatening, infection. After an incubation period of typically 5-14 days, infected individuals often present with fever of abrupt onset, pronounced headache, and dry cough. In more severe cases, shortness of breath and chest tightness may occur (Crosse 1990; Balsamo et al. 2017). For a long time, *C. psittaci* was thought to be the only cause of zoonotic chlamydial disease in humans. However, several recent studies suggest that other chlamydial agents (e.g. *C. abortus, C. caviae*) can cause similar symptoms (Laroucau et al. 2009; Ortega et al. 2016; Ramakers et al. 2017; Van Grootveld et al. 2018). Awareness of zoonotic chlamydial disease is generally low among the general public and

even medical doctors (Beeckman and Vanrompay 2009). Effective antibiotic treatment is available, but there is no licensed vaccine against zoonotic chlamydial infection in humans (Ran et al. 2017).

Most human cases of ornithosis are associated with psittacine birds or pigeons, but wild birds are also a possible source of infection (Heddema et al. 2006; Vanrompay et al. 2007). There are few studies on the prevalence of *Chlamydiaceae* in birds from Switzerland but no study concerning raptors and crows. One study focusing on *C. psittaci* in pigeons, songbirds, and waterfowl in Switzerland reported a prevalence of 14.3%, 0.4%, and 4.3%, respectively (Zweifel et al. 2009). Mattmann et al. (2019) investigated the *Chlamydiaceae* prevalence in pigeons from different geographical areas in Switzerland and found a total prevalence of 16.9%. Distinct differences depending on the geographical location of the birds were detected and the prevalence was higher in the greater Zurich area compared to the city of Lucerne in both studies.

In other European countries, several studies investigating the prevalence of *Chlamydiaceae* in raptors have been published. The prevalence of *Chlamydiaceae* varies widely between European countries, but also within countries. In Sweden, Blomqvist et al. (2012) found a *C. psittaci* prevalence of 1.3% in peregrine falcons (*Falco peregrinus*) and white-tailed sea eagles (*Haliaeetus albicilla*) by real-time PCR (qPCR). Gerbermann and Korbel (1993) reported a *C. psittaci* prevalence of 13.2% in raptors from southern Germany by antigen ELISA, whereas Schettler et al. (2003) found that 74.4% of the sampled raptors were positive for *C. psittaci* in eastern Germany by nested PCR.
Only few studies regarding *Chlamydiaceae* in corvids from European countries have been published. In Poland, Szymańska-Czerwińska et al. (2017) found a prevalence of 13.4% by qPCR, while in Italy a *Chlamydiaceae* prevalence of 28.9% has been reported in corvids by nested PCR (Di Francesco et al. 2015).

Several studies investigating wild birds found chlamydial species that could not be characterized, but were identified as genetic intermediates between *C. abortus* and *C. psittaci* (Fukushi and Hirai 1988; Vanrompay et al. 1997; Herrmann et al. 2000; Van Loock et al. 2003; Madani and Peighambari 2013; Aaziz et al. 2015; Krawiec et al. 2015; Luján-Vega et al. 2018; Liu et al. 2019). One of these intermediates had initially been detected in a red-tailed hawk (*Buteo jamaicensis*) in the 1990s (Mirandé et al. 1992). The organism was identified as *C. psittaci* in cell culture with immunofluorescent staining at that time. The genome of this isolate was later re-evaluated and recently classified as the new species *C. buteonis*, together with a new isolate found in a red-shouldered hawk (*Buteo lineatus*) (Joseph et al. 2015; Laroucau et al. 2019). The clinical importance of *C. buteonis* is still unknown as few studies have focused on clinical signs associated with chlamydial infections in raptors. However, both the red-tailed hawk and the red-shouldered hawk from which *C. buteonis* was isolated showed clinical signs of avian chlamydiosis. The red-tailed hawk showed signs of respiratory distress and diarrhea, the red-shouldered hawk suffered from conjunctivitis.

The aim of the present study was: i) the collection of data on the prevalence of *Chlamydiaceae* in raptors and corvids in Switzerland, and ii) the characterization of the involved chlamydial species, with a special interest in the aforementioned, so far not fully characterized "intermediates" and the new species *C. buteonis* considering the limited information available for these organisms.

3. Material and methods

3.1 Samples

Sampling was performed between April 2018 and January 2020. In total, 594 birds originating from 19 Swiss cantons were investigated (Table 1). A total of 1128 samples were collected from 594 birds representing 22 different species belonging to four orders. In detail, 483 samples were collected from 253 corvids of six species and 645 samples from 341 raptors representing 16 species. Samples consisted of dry choanal (n = 519), cloacal (n = 520) and fecal (n = 89) swabs. Choanal and cloacal swabs were obtained from deceased birds (n = 528), whereas from living birds (n = 66) only fresh fecal material was sampled with swabs after defecation. Twenty-three birds died or were euthanized during treatment, therefore fecal, choanal and cloacal swabs were available from these birds. Dead birds or their samples were obtained from the bird rehabilitation center of the Swiss Ornithological Institute in Sempach, Lucerne, the Wildlife Rehabilitation Center Landshut, Utzenstorf, Berne, the Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich as well as from gamekeepers and local hunters of various cantons. Carcasses of birds of prey and Corvidae were found dead or were euthanized due to incurable trauma or disease. In addition, further corvids were shot in the scope of cantonal population control programs to reduce the number of birds. All living birds were inpatients either at the bird rehabilitation center of the Swiss Ornithological Institute or at the Wildlife Rehabilitation Center Landshut, Utzenstorf, canton of Berne. None of the birds were killed intentionally for this study. Paired choanal and cloacal swabs were available from 511 birds. For sampling, dry swabs (FLOQSwab®, Copan Flock Technologies, Brescia, Italy) were used and stored in cryovials at -80°C until further processing. Whenever possible, tested birds were categorized as either “juvenile” (hatched in the year of sampling) or “adult” (hatched before the year of sampling), based on the known date of hatching or age estimates according to exterior features (Kalchreuter 1971, Moning and Langenberg 2005). Furthermore, the canton of origin and date of sampling were noted if available.

Table 1. Number of raptors and corvids with sample types obtained in this study per bird species.

Order	Family	Species name (Latin)	Species name (English)	Species name (German)	Number of birds	Number of choanal swabs	Number of cloacal swabs	Number of fecal swabs
Accipitriformes	Accipitridae	*Gypaetus barbatus*	Bearded vulture	Bartgeier	1	1	1	0
		Milvus migrans	Black kite	Schwarzmilan	6	4	4	3
		Buteo buteo	Common buzzard	Mäusebussard	142	127	128	14
		Accipiter nisus	Eurasian sparrowhawk	Sperber	32	32	32	1
		Pernis apivorus	European honey-buzzard	Wespenbussard	1	1	1	0
		Aquila chrysaetos	Golden eagle	Steinadler	6	3	6	0
		Circus pygargus	Montagu's harrier	Wiesenweihe	1	1	1	0
		Accipiter gentilis	Northern goshawk	Habicht	2	2	2	0
		Milvus milvus	Red kite	Rotmilan	23	20	21	2
Falconiformes	Falconidae	*Falco tinnunculus*	Common kestrel	Turmfalke	66	54	55	12
		Falco subbuteo	Eurasian hobby	Baumfalke	4	3	3	1
		Falco peregrinus	Peregrine falcon	Wanderfalke	1	1	1	0
Passeriformes	Corvidae	*Corvus corone*	Carrion crow	Aaskrähe	207	190	187	19
		Garrulus glandarius	Eurasian jay	Eichelhäher	9	9	8	1
		Pica pica	Eurasian magpie	Elster	30	16	16	22
		Corvus cornix	Hooded crow	Nebelkrähe	1	1	1	0
		Corvus frugilegus	Rook	Saatkrähe	3	3	3	2
		Corvus monedula	Western jackdaw	Dohle	3	1	1	3
Strigiformes	Strigidae	*Bubo bubo*	Eurasian eagle-owl	Uhu	4	4	4	0
		Asio otus	Long-eared owl	Waldohreule	17	15	14	2
		Strix aluco	Tawny owl	Waldkauz	18	14	14	6
	Tytonidae	*Tyto alba*	Barn owl	Schleiereule	17	17	17	1
Total					**594**	**519**	**520**	**89**

3.2 DNA extraction

DNA of the choanal and cloacal swabs was extracted using a commercial kit (Genomic DNA from tissue, NucleoSpin® Tissue from Macherey-Nagel, Düren, Germany) according to manufacturer's instructions. For each extraction lot, a negative control was prepared by using "Buffer T1" instead of the sample. DNA of the fecal samples was extracted with the NucleoSpin® Stool kit (Macherey-Nagel, Düren, Germany) according to the company recommendations. Quality (260/280 value) and quantity of extracted DNA was measured using a Nanodrop 2000c spectrophotometer (Thermo Fisher Scientific, Waltham, MA, USA). The extracted DNA was stored at -20°C until further use.

3.3 *Chlamydiaceae* screening and identification

The investigation of all extracted DNA samples (n = 1128) was performed following the decision tree shown in Figure 1. All quantitative real-time PCRs (qPCR) were run on an Applied Biosystems® 7500 Real-Time PCR System (Thermo Fisher Scientific) with the fast cycling profile (50°C for 2 min, 95°C for 10 min, 95°C for 15 sec). As internal amplification control, eGFP was added to the reaction mix as previously described (Hoffmann et al. 2005; Hoffmann et al. 2006; Blumer et al. 2011). Detailed information about all primers and probes used in this study are listed in Table 2.

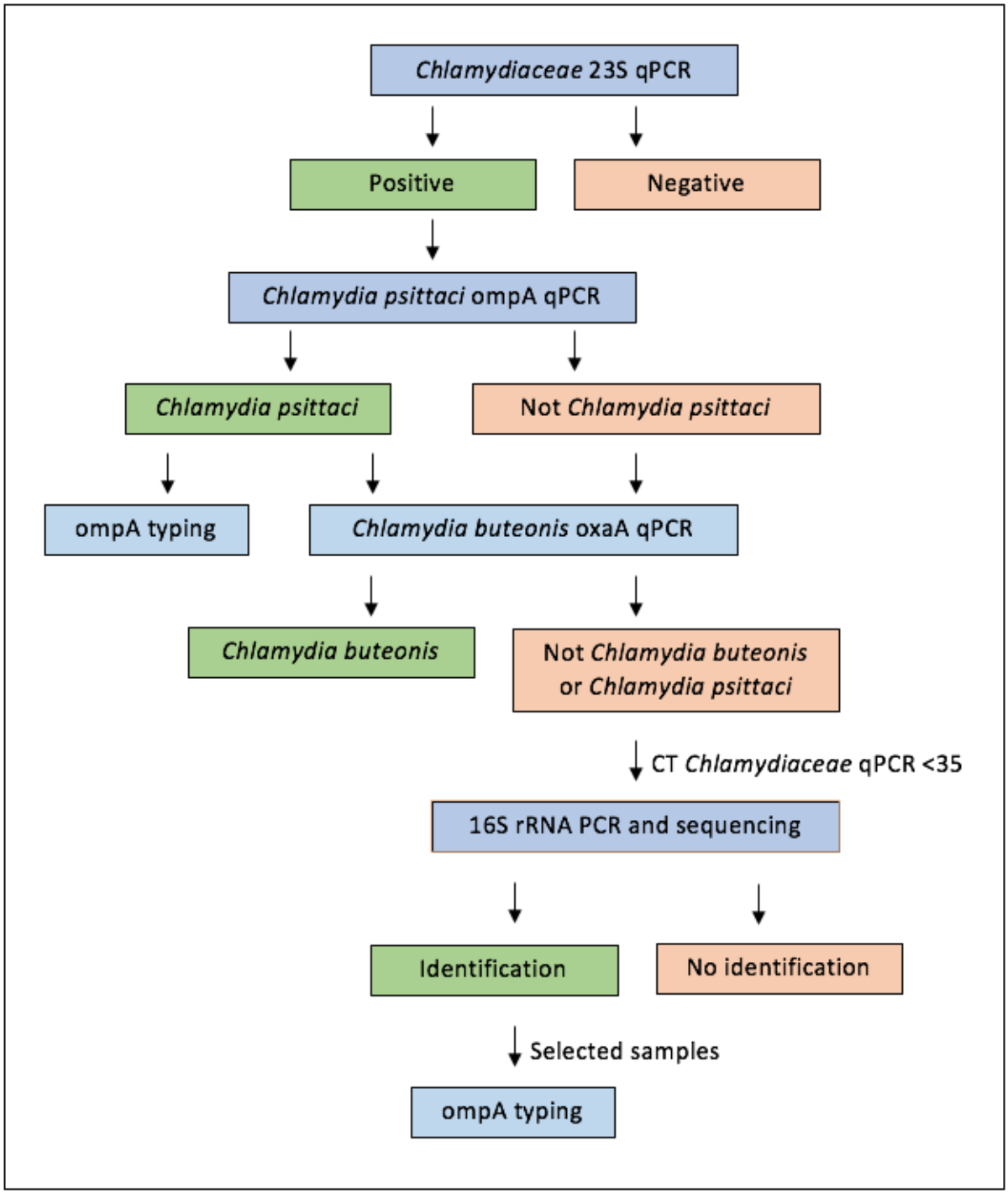

Figure 1. Flowchart of the methodical approach used in this study to detect and identify *Chlamydiaceae* in raptors and corvids from Switzerland. *ompA* = outer membrane protein A; *oxaA* = oxidase assembly A; qPCR = real-time PCR; CT = cycle threshold value.

Table 2. Detailed information about the primers and probes used in this study for the detection of *Chlamydiaceae* in raptors and corvids, including their final concentration in the PCR reagent mix. *ompA* = outer membrane protein A; *oxaA* = oxidase assembly A; qPCR = real-time PCR.

Method	Target	Final concentration	Primer & Probe	Sequence (5'-3')	Amplicon size (base pairs)	Annealing temperature (°C)	References
Chlamydiaceae 23S rRNA qPCR	23S rRNA	500nM	Ch23S-F	CTGAAACCAGTAGCTTATAAGCGGT	111	60	Ehricht et al. (2006)
			Ch23S-R	ACCTCGCCGTTTAACTTAACTCC			
		200nM	Ch23S-P	FAM-CTCATCATGCAAAAGGCACGCCG-TAMRA			
	eGFP	200nM	eGFP-1-F	GACCACTACCAGCAGAACAC	177		Hoffmann et al. (2006) PCR modified by Blumer et al. (2011)
			eGFP-10-R	CTTGTACAGCTCGTCCATGC			
			eGFP-HEX	HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1			
C. psittaci ompA qPCR	*ompA*	900nM	CppsOMP1-F	CACTATGTGGGAAGGTGCTTCA	76	60	Pantchev et al. (2009)
			CppsOMP1-R	CTGCGCGGATGCTAATGG			
		200nM	CppsOMP1-S	FAM-CGCTACTTGGTGTGAC-TAMRA			
	eGFP	900nM	eGFP-1-F	GACCACTACCAGCAGAACAC	132		Hoffmann et al. (2005)
			eGFP-2-R	GAACTCCAGCAGGACCATG			
		200nM	eGFP-HEX	HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1			
16S rRNA PCR (short)	16S rRNA	300nM	16S IGF (short)	GATGAGGCATGCAAGTCGAACG	298	65	Everett et al. (1999) Blumer et al. (2007)
			16S IGR (short)	CCAGTGTTGGCGGTCAATCTCTC			
16S rRNA PCR (near-full length)	16S rRNA	300nM	16S-IGF	CGGCGTGGATGAGGCAT	1487	57.5	Everett et al. (1999) Hosokawa et al. (2006)
			16S-B1	TACGGYTACCTTGTTACGACTT			
C. *buteonis oxaA* qPCR	*oxaA*	600nM	RSHA-F	ATTTCCAACACGCACTGCAT	80	60	Laroucau et al. (2019)
			RSHA-R	TGGGACTAGGTGTTCTCCCT			
		200nM	RSHA-P	FAM-GGACAACATGCCTAGATGAAGA-TAMRA			
	eGFP	400nM	eGFP-1-F	GACCACTACCAGCAGAACAC	132		Hoffmann et al. (2005)
			eGFP-2-R	GAACTCCAGCAGGACCATG			
		200nM	eGFP-HEX	HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1			
ompA typing PCR	*ompA*	200nM	ompA F (CTU)	ATGAAAAAACTCTTGAAATCGG	1212	49	Sachse et al. (2008)
			ompA rev	TCCTTAGAATCTGAATTGAGC			

3.4 *Chlamydiaceae* 23S qPCR

All samples (n = 1128) were analyzed with a 23S rRNA based *Chlamydiaceae* family-specific real-time PCR as described previously (Ehricht et al. 2006). All samples were tested in duplicates. The cycle threshold (CT) was set at 0.1 in each run and a sevenfold dilution series of *C. abortus* was included as a standard curve in each run. Molecular grade water was used as a negative control. Samples with questionable results were retested in duplicates. Samples with inhibited amplification were retested undiluted and tenfold diluted, both in duplicates.

3.5 *C. psittaci ompA* qPCR

All *Chlamydiaceae* positive samples were subsequently tested with the *C. psittaci*-specific qPCR according to the protocol as described by Pantchev et al. (2009). The reaction mix contained 4 µl (< 150 ng/µl) sample template, 1 µl eGFP template, 1x TaqMan Universal PCR MasterMix, 900 nM of the primers CppsOMP1-F and CppsOMP1-R, 200 nM probe CppsOMP1-S, 900 nM of the primers eGFP-1-F and eGFP 2-R, and 200 nM probe eGFP-HEX in a final volume of 25 µl. A negative control (aqua bidest.) and a positive control (synthesized oligonucleotide of the *ompA* gene of a *C. psittaci* field isolate "T0592/03, amazon parrot" (National Reference Centre for poultry and Rabbit Disease, University of Zurich); synthesized by Microsynth, Balgach, Switzerland) were used in duplicates in each run (Mattmann et al. 2019).

3.6 *C. buteonis oxaA* qPCR

The *C. buteonis*-specific qPCR was performed as previously described (Laroucau et al. 2019), in all *Chlamydiaceae* positive samples. The reaction mix contained 4 µl sample template, 1 µl eGFP template, 12.5 µl TaqMan Universal PCR MasterMix, 600 nM of the primers RSHA-F and RSHA-R, 200 nM probe RSHA-P, 400 nM of the primers eGFP-1-F and eGFP-2-R, and 200 nM probe eGFP-HEX in a final volume of 25 µl. A negative control (aqua bidest.) and a positive control (DNA of *C. buteonis* RSHA, kindly provided by Karine Laroucau, ANSES, Maison-Alfort, France) were used in duplicates in each run.

3.7 16S rRNA PCR and sequencing

Samples negative by both previously described species-specific qPCRs and fulfilling the requirement of a mean Cycle threshold (CT)-value < 35 in the *Chlamydiaceae* 23S qPCR were subjected to the 16S rRNA conventional PCR as previously described (Everett et al. 1999), using the modified primers 16S IGF (short) and 16S IGR (short) (Blumer et al. 2007) to amplify a sequence of 278 base pairs (bp). Per sample, a 50 µl reaction mix was prepared, containing 5 µl (< 150 ng/µl) sample template, 25 µl Red Taq Ready Mix and 300 nM of both the forward (16S IGF) and the reverse (16S IGR) primer. Cycling conditions were 95°C for 5 min, followed by 40 cycles of 95°C for 60 s, 65°C for 60 s, 72°C for 90 s, and a final extension of 72°C for 10 min.
Ten samples were selected based on the result of the 16S (short) sequencing, host species, geographical location, and mean CT value in the *Chlamydiaceae* 23S qPCR and subjected to the near-full length 16S rRNA conventional PCR to amplify a sequence of 1481bp (Taylor-Brown et al. 2015). The reaction mix was identical to the reaction mix described above, but instead of 16S IGF (short) and 16S IGR (short), the forward and reverse primers 16S-IGF (Everett et al. 1999) and 16S-B1 (Hosokawa et al. 2006) were used, respectively. Cycling conditions were identical to those described above, with the only difference that the annealing

temperature was set at 57.5°C instead of 65°C.
Products from all conventional PCRs were purified using the QIAquick® PCR Purification Kit (Qiagen) according to the manufacturer's instructions. Purified amplicons were Sanger sequenced by Microsynth (Balgach, Switzerland). The obtained sequences were assembled and analyzed using the Geneious Prime software (version 2019.2.3, https://www.geneious.com) and compared against the NCBI database using the BLASTn tool (NCBI, https://blast.ncbi.nlm.nih.gov/).

3.8 *ompA* genotyping PCR

Per sample, a reaction mix with a final volume of 50 µl containing 25 µl REDTaq ReadyMix (Merck KGaA, Darmstadt, Germany), 200 nM of the primers ompA F (CTU) and ompA rev (Sachse et al. 2008), and 3 µl sample template with a DNA concentration of 25 ng/µl was prepared. Cycling conditions were 10 min at 95°C, followed by 35 cycles of 95°C for 30 s, 49°C for 30 s, 72°C for 60 s, and a final elongation at 72°C for 7 min (Sachse et al. 2008). If amplification resulted in weak bands, a modified cycling protocol with 40 cycles of 95°C for 60 s, 49°C for 60 s, 72°C for 90 s was used (Mattmann et al. 2019). Analysis of *ompA* nucleotide sequences was conducted using Geneious version 10.2 (Biomatters Ltd., available from https://www.geneious.com). Multiple sequence alignments were handled using MAFFT v7.450 (Katoh and Standley 2013) using the Auto algorithm and scoring matrix: 200PAM / k=2. Phylogenetic trees were reconstructed using RAxML v8 (Stamatakis 2014) with nucleotide model GTR GAMMA and the Rapid-hill climbing algorithm.

3.9 Statistical analysis

Statistical analyses were carried out using SPSS version 26 software. The value of $p < 0.01$ was considered statistically significant.

4. Results

4.1 *Chlamydiaceae* 23S qPCR

4.1.1 Species

Results of the *Chlamydiaceae* 23S qPCR for the different bird species are presented in Table 3. In total, 119 samples (10.5%) from 80 birds (13.5%) were positive for *Chlamydiaceae.* In corvids, *Chlamydiaceae* were detected in 60/253 animals (23.7%), while 20/341 raptors (5.9%) were positive. The odds ratio showed that the probability of *Chlamydiaceae* infection was five times higher in corvids than in raptors (OR = 4.99 [95% confidence interval (CI): 2.92-8.53], $p < 0.01$). *Chlamydiaceae* were detected in representatives of six raptor species, namely in 13/142 common buzzards (*Buteo buteo*), 3/32 Eurasian sparrowhawks (*Accipiter nisus*), 1/23 red kites (*Milvus milvus*), 1/66 common kestrels (*Falco tinnunculus*), 1/17 long-eared owls (*Asio otus*), and 1/17 barn owls (*Tyto alba*). In corvids, 59/207 carrion crows (*Corvus corone*) (28.5%) and 1/3 rooks (*Corvus frugilegus*) were positive for *Chlamydiaceae*.

Table 3. Total number and percentage of raptors and corvids positive for *Chlamydiaceae* per species and number and percentage of chlamydial species identified.

Species name	***Chlamydiaceae* qPCR pos. (%)**	**Final classification**						
		***C. abortus*/ *C. psittaci* (%)**	***C. psittaci* M56 (%)**	***C. psittaci* A (%)**	***C. psittaci* 6N (%)**	***C. psittaci* 1V (%)**	***C. psittaci* D (%)**	**Not further identified (%)**
Bearded vulture	0	0	0	0	0	0	0	0
Black kite	0	0	0	0	0	0	0	0
Common buzzard	13 (9.2%)	0	5 (38.5%)	1 (7.7%)	0	1 (7.7%)	0	6 (46.2%)
Eurasian sparrowhawk	3 (9.4%)	0	0	1 (33.3%)	0	0	0	2 (66.7%)
European honey-buzzard	0	0	0	0	0	0	0	0
Golden eagle	0	0	0	0	0	0	0	0
Montagu's harrier	0	0	0	0	0	0	0	0
Northern goshawk	0	0	0	0	0	0	0	0
Red kite	1 (4.3%)	0	0	0	0	0	0	1 (100%)
Accipitridae subtotal	**17 (7.9%)**	**0**	**5 (29.4%)**	**2 (11.8%)**	**0**	**1 (5.9%)**	**0**	**9 (52.9%)**
Common kestrel	1 (1.5%)	0	1 (100%)	0	0	0	0	0
Eurasian hobby	0	0	0	0	0	0	0	0
Peregrine falcon	0	0	0	0	0	0	0	0
Falconidae subtotal	**1 (1.4%)**	**0**	**1 (100%)**	**0**	**0**	**0**	**0**	**0**
Carrion crow	59 (28.5%)	23 (39.0%)	0	0	1 (1.7%)	21 (35.6%)	3 (5.1%)	11 (18.6%)
Eurasian jay	0	0	0	0	0	0	0	0
Eurasian magpie	0	0	0	0	0	0	0	0
Hooded crow	0	0	0	0	0	0	0	0
Rook	1 (33.3%)	0	0	0	0	1 (100%)	0	0
Western jackdaw	0	0	0	0	0	0	0	0
Corvidae subtotal	**60 (23.7%)**	**23 (38.3%)**	**0**	**0**	**1 (1.7%)**	**22 (36.7%)**	**3 (5.0%)**	**11 (18.3%)**
Eurasian eagle-owl	0	0	0	0	0	0	0	0
Long-eared owl	1 (5.9%)	0	1 (100%)	0	0	0	0	0
Tawny owl	0	0	0	0	0	0	0	0
Strigidae subtotal	**1 (2.6%)**	**0**	**1 (100%)**	**0**	**0**	**0**	**0**	**0**
Barn owl	1 (5.9%)	0	0	0	0	0	0	1 (100%)
Total	**80 (13.5%)**	**23 (28.8%)**	**7 (8.8%)**	**2 (2.5%)**	**1 (1.3%)**	**23 (28.8%)**	**3 (3.8%)**	**21 (26.3%)**

4.1.2 Origin

Chlamydiaceae positive birds were detected in nine of the 19 Swiss cantons tested as shown in Table 4. Significant differences of the detection rates depending on the geographical origin of the birds were noted, based on the chi square test. Significantly higher rates of *Chlamydiaceae* positivity was detected in the cantons Zug (52.9%; $p < 0.01$) and Zurich (24.2%; $p < 0.01$) compared to the other cantons tested. In Zurich, the probability of *Chlamydiaceae* shedding was more than twice as high as in other parts of Switzerland (OR = 2.71 [1.61-4.55], $p < 0.01$). In Zug it was even 3.5x higher than in Zurich (OR = 3.52 [1.78-6.93]; $p < 0.01$) and more than ten times higher than in all other cantons combined (OR = 10.38 [5.52-19.53], $p < 0.01$). The lowest detection rate of the cantons of which at least one bird was positive was found in Lucerne (1.7%). It was the only canton where the detection rate was significantly lower than the total detection rate (OR = 0.08 [0.02-0.34], $p < 0.01$).

Table 4. *Chlamydiaceae* detection rates of raptors and corvids per canton. Detection rates that differ significantly from the total detection rate based on chi square test ($p < 0.01$) are shown in bold.

Greater region	**Swiss Canton**	**Number of birds**	***Chlamydiaceae* positive (%)**
Lake Geneva	Geneva	15	0
	Valais	11	0
Espace Mittelland	Bern	56	5 (8.9%)
	Fribourg	18	1 (5.6%)
	Solothurn	13	0
Northwestern Switzerland	Aargau	31	1 (3.2%)
	Basel District	4	0
Zurich	Zurich	132	**32 (24.2%)**
Eastern Switzerland	Glarus	1	0
	Grisons	10	0
	Schaffhausen	9	1 (11.1%)
	St. Gallen	6	0
	Thurgau	14	1 (7.1%)
Central Switzerland	Lucerne	115	**2 (1.7%)**
	Nidwalden	3	0
	Obwalden	5	1 (20.0%)
	Uri	1	0
	Zug	51	**27 (52.9%)**
Ticino	Ticino	6	0
Unknown	Unknown	93	9 (9.7%)

4.1.3 Swab type

Chlamydiaceae were detected in 13.9% of the choanal (n = 72), 8.8% of the cloacal (n = 46), and 1.1% of the fecal (n = 1) swabs. Paired choanal and cloacal swabs were available from 79 birds that tested positive for *Chlamydiaceae* in at least one site. Successful detection of *Chlamydiaceae* positive birds was significantly higher ($p < 0.01$) with choanal swabs, which detected 72/79 (91.1%) of the cases, compared to cloacal swabs, which only detected 46/79 cases (58.2%). No appropriate comparison with fecal swabs was possible due to the limited number of birds where all three swab types were available.

4.1.4 Age

In total, the age of 395 birds was known or estimated, of which 276 birds (208 raptors and 68 corvids) were considered adults and 119 (39 raptors and 80 corvids) were juveniles. Thirty-four (12.4%) adult birds were positive in the *Chlamydiaceae* specific qPCR, whereas only three (2.5%) juveniles were positive indicating that adults have a significantly higher detection rate (OR = 5.43 [1.64-18.06], $p < 0.01$). In raptors alone, detection rate was higher in adults (8.2%) than in juveniles (2.6%) but the difference was statistically not significant (OR = 3.38 [0.44-26.18], $p = 0.22$). However, in corvids, the detection rate in adults (25.0%) was significantly higher than in juveniles (2.5%) (OR = 13.00 [2.88-58.68], $p < 0.01$).

4.2 *C. psittaci* qPCR

Of the 119 *Chlamydiaceae*-positive samples, two were positive in the *C. psittaci* specific qPCR. Both of them originated from raptors, one from a Eurasian sparrowhawk (Nr. 268C), the other from a common buzzard (Nr. 683C). Both specimens were choanal swabs and in both animals the cloacal swab was negative by the *Chlamydiaceae* 23S qPCR.

4.3 *C. buteonis* qPCR

All 119 *Chlamydiaceae* positive samples were negative by the *C. buteonis* species-specific qPCR.

4.4 16S rRNA conventional PCR and sequencing

The 16S rRNA short sequencing of 278bp was successfully generated in 74 samples from 55 individuals that met the requirements (Table 5); eight samples from six raptors and 66 samples from 49 crows. 16S sequences generated in this study are accessible in Genbank under accession numbers MT423441 – MT423514. Seven samples (Nr. 14C, 311K, 556C, 556K, 669K, 671C, 671K) from five raptors were identified as *C. psittaci* M56 (Accession number: CP003795.1). The remaining sample (Nr. 566C), a choanal swab from a common buzzard, showed 100% sequence identity with two *C. abortus* strains (*C. abortus* 15-58d44 (Accession number: LS974600.1), and *C. abortus* 15-58d/44 (Accession number: KX870502.1) and with three *C. psittaci* isolates (*C. psittaci* nier_A97 (Accession number: KX603686.1), *C. psittaci* nier_A101 (Accession number: KX603687.1), and *C. psittaci* nier_A113 (Accession number: KX603688.1)). These five organisms also showed the highest similarity with the sequences obtained from all the 66 samples from corvids with identities ranging from 95.58% to 100%. The amplified sequence was identical in these five organisms.
The ten samples selected for 16S rRNA near-full length conventional PCR originated from one Eurasian sparrowhawk (Nr. 268C), one common kestrel (Nr. 311K), one rook (Nr. 621C), two common buzzards (Nr. 556K, 566C), and five carrion crows (Nr. 565C, 746C, 769C, 814C, 972C) (Table 6). The 16S near-full length sequences are accessible in Genbank under accession numbers MT429304 and MT430892 - MT430900. The results were very similar to those of the 16S rRNA short PCR. Two strains found in a common buzzard (Nr. 556K) and a common kestrel (Nr. 311K) showed high nucleotide identity with *C. psittaci* M56 with identities of 100% and 99.57%, respectively. The strains found in the five carrion crows (Nr. 565C, 746C, 769C, 814C, 972C) one rook (Nr. 621C), and one common buzzard (Nr. 566C) again showed high sequence similarity with the five aforementioned *C. abortus* and *C. psittaci* strains with identities ranging from 99.72% to 100%. The strain detected in the

Eurasian sparrowhawk (Nr. 268C) showed high sequence identity (97.99%) with several *C. psittaci* and *C. abortus* strains, including *C. psittaci* Ful127 (Accession number: CP033059.1), *C. abortus* 84/2334 (Accession number: CP031646.1), *C. psittaci* GIMC 2005 (Accession number: CP024451.1), and *C. psittaci* WC (Accession number: CP003796.1).

Table 5. Sequence length, sequence quality, first hit by nucleotide identity when compared against the NCBI database and accession number of 16S rRNA (short) sequences generated in this study from eight samples from six raptors and 66 samples from 49 corvids from Switzerland.

Sample Nr.	Species name (English)	Sequence length (bp)	Sequence quality (%)	First hit	Nucleotide identity (%)	Accession number
14C	Common buzzard	245	26.1	*C. psittaci* M56	99.59	MT423441
311K	Common kestrel	269	80.3	*C. psittaci* M56	100	MT423442
556C	Common buzzard	239	30.1	*C. psittaci* M56	100	MT423443
556K	Common buzzard	278	83.1	*C. psittaci* M56	100	MT423444
565C	Carrion crow	253	82.2	*C. abortus* 15-58d44	100	MT423445
566C	Common buzzard	278	80.9	*C. abortus* 15-58d44	100	MT423446
621C	Rook	274	75.2	*C. abortus* 15-58d44	100	MT423447
669K	Common buzzard	271	83.0	*C. psittaci* M56	100	MT423448
671C	Common buzzard	260	32.7	*C. psittaci* M56	98.85	MT423449
671K	Common buzzard	269	77.3	*C. psittaci* M56	100	MT423450
686C	Carrion crow	271	40.6	*C. abortus* 15-58d44	99.63	MT423451
688C	Carrion crow	252	80.2	*C. abortus* 15-58d44	100	MT423452
688K	Carrion crow	279	73.8	*C. abortus* 15-58d44	100	MT423453
689C	Carrion crow	271	79.3	*C. abortus* 15-58d44	100	MT423454
689K	Carrion crow	249	25.7	*C. abortus* 15-58d44	95.58	MT423455
690C	Carrion crow	253	80.6	*C. abortus* 15-58d44	100	MT423456
696C	Carrion crow	276	78.3	*C. abortus* 15-58d44	100	MT423457
702C	Carrion crow	275	80.7	*C. abortus* 15-58d44	100	MT423458
705C	Carrion crow	278	71.6	*C. abortus* 15-58d44	100	MT423459
706C	Carrion crow	256	80.1	*C. abortus* 15-58d44	100	MT423460
711C	Carrion crow	260	85.4	*C. abortus* 15-58d44	100	MT423461
716K	Carrion crow	272	84.2	*C. abortus* 15-58d44	100	MT423462
721C	Carrion crow	253	81.4	*C. abortus* 15-58d44	100	MT423463
725C	Carrion crow	267	81.3	*C. abortus* 15-58d44	100	MT423464
735C	Carrion crow	267	76.8	*C. abortus* 15-58d44	100	MT423465
736C	Carrion crow	253	80.6	*C. abortus* 15-58d44	100	MT423466
736K	Carrion crow	271	76.8	*C. abortus* 15-58d44	100	MT423467
737C	Carrion crow	275	77.5	*C. abortus* 15-58d44	100	MT423468
737K	Carrion crow	315	63.8	*C. abortus* 15-58d44	96.96	MT423469
740C	Carrion crow	260	82.7	*C. abortus* 15-58d44	100	MT423470
740K	Carrion crow	260	73.5	*C. abortus* 15-58d44	100	MT423471
744C	Carrion crow	278	77.3	*C. abortus* 15-58d44	100	MT423472
746C	Carrion crow	266	84.6	*C. abortus* 15-58d44	100	MT423473
750C	Carrion crow	276	76.4	*C. abortus* 15-58d44	100	MT423474
750K	Carrion crow	250	21.2	*C. abortus* 15-58d44	98.40	MT423475
751C	Carrion crow	269	85.9	*C. abortus* 15-58d44	100	MT423476
751K	Carrion crow	226	32.7	*C. abortus* 15-58d44	100	MT423477
752C	Carrion crow	278	62.2	*C. abortus* 15-58d44	100	MT423478
752K	Carrion crow	253	51.0	*C. abortus* 15-58d44	100	MT423479
753C	Carrion crow	274	75.9	*C. abortus* 15-58d44	100	MT423480
754C	Carrion crow	267	82.8	*C. abortus* 15-58d44	100	MT423481
756C	Carrion crow	278	75.5	*C. abortus* 15-58d44	100	MT423482
756K	Carrion crow	240	28.3	*C. abortus* 15-58d44	99.17	MT423483
759C	Carrion crow	278	72.7	*C. abortus* 15-58d44	100	MT423484

760C	Carrion crow	279	68.1	*C. abortus* 15-58d44	100	MT423485
760K	Carrion crow	250	53.2	*C. abortus* 15-58d44	100	MT423486
761C	Carrion crow	256	81.3	*C. abortus* 15-58d44	100	MT423487
764C	Carrion crow	276	71.7	*C. abortus* 15-58d44	100	MT423488
765C	Carrion crow	278	78.8	*C. abortus* 15-58d44	100	MT423489
769C	Carrion crow	276	81.2	*C. abortus* 15-58d44	100	MT423490
770C	Carrion crow	256	75.4	*C. abortus* 15-58d44	100	MT423491
772C	Carrion crow	267	82.8	*C. abortus* 15-58d44	100	MT423492
772K	Carrion crow	270	80.4	*C. abortus* 15-58d44	100	MT423493
773C	Carrion crow	269	76.6	*C. abortus* 15-58d44	100	MT423494
774C	Carrion crow	277	75.1	*C. abortus* 15-58d44	100	MT423495
797C	Carrion crow	275	77.1	*C. abortus* 15-58d44	100	MT423496
797K	Carrion crow	265	64.2	*C. abortus* 15-58d44	100	MT423497
798C	Carrion crow	277	75.8	*C. abortus* 15-58d44	100	MT423498
798K	Carrion crow	271	81.2	*C. abortus* 15-58d44	100	MT423499
814C	Carrion crow	266	82.7	*C. abortus* 15-58d44	100	MT423500
814K	Carrion crow	278	74.8	*C. abortus* 15-58d44	100	MT423501
826C	Carrion crow	266	77.8	*C. abortus* 15-58d44	100	MT423502
846C	Carrion crow	276	71.7	*C. abortus* 15-58d44	100	MT423503
847C	Carrion crow	238	43.3	*C. abortus* 15-58d44	99.58	MT423504
848C	Carrion crow	267	82.8	*C. abortus* 15-58d44	100	MT423505
850C	Carrion crow	256	75.4	*C. abortus* 15-58d44	100	MT423506
850K	Carrion crow	278	65.5	*C. abortus* 15-58d44	100	MT423507
851C	Carrion crow	264	82.6	*C. abortus* 15-58d44	100	MT423508
856C	Carrion crow	267	80.1	*C. abortus* 15-58d44	100	MT423509
858C	Carrion crow	255	74.9	*C. abortus* 15-58d44	100	MT423510
858K	Carrion crow	271	77.1	*C. abortus* 15-58d44	100	MT423511
861C	Carrion crow	276	80.1	*C. abortus* 15-58d44	100	MT423512
861K	Carrion crow	270	40.0	*C. abortus* 15-58d44	99.63	MT423513
972C	Carrion crow	260	83.8	*C. abortus* 15-58d44	100	MT423514

Table 6. Sequence length, sequence quality, first hit by nucleotide identity when compared against the NCBI database and accession number of 16S rRNA (near-full length) sequences generated in this study from four raptors and six corvids from Switzerland.

Sample Nr.	Species name (English)	Sequence length (bp)	Sequence quality (%)	First hit	Nucleotide identity (%)	Accession number
268C	Eurasian sparrowhawk	1000	86.1	*C. psittaci* Ful127	97.99	MT430892
311K	Common kestrel	921	78.8	*C. psittaci* M56	99.57	MT429304
556K	Common buzzard	1395	95.8	*C. psittaci* M56	100	MT430893
565C	Carrion crow	996	98.4	*C. psittaci* nier_A113	99.90	MT430894
566C	Common buzzard	1147	94.9	*C. psittaci* nier_A113	100	MT430895
621C	Rook	1357	91.4	*C. psittaci* nier_A113	100	MT430896
746C	Carrion crow	1218	95.7	*C. psittaci* nier_A113	99.92	MT430897
769C	Carrion crow	1370	95.5	*C. psittaci* nier_A113	99.85	MT430898
814C	Carrion crow	1379	93.8	*C. psittaci* nier_A97	99.93	MT430899
972C	Carrion crow	1071	93.8	*C. psittaci* nier_A113	99.72	MT430900

4.5 *ompA* genotyping

Amplification and sequencing of the *ompA* gene was successful in both samples positive for *C. psittaci* and 33 selected samples that were positive for *Chlamydiaceae* but negative by both species-specific qPCRs (Table 7). The 33 samples were selected based on the mean CT-value in the *Chlamydiaceae* 23S qPCR, host species, and geographical location and originated from

five common buzzards (Nr. 511C, 556K, 566C, 669C, 671K), one common kestrel (Nr. 311K), one long-eared owl (877K), one rook (621C), and 25 carrion crows (565C, 688C, 689C, 690C, 706C, 711C, 716K, 721C, 735C, 736C, 740C, 746C, 751C, 752C, 761C, 772K, 798K, 814C, 826C, 848C, 850K, 856C, 858C, 861K, 972C). The *ompA* sequences generated in this study are accessible in Genbank under accession numbers MT450242 – MT450276. Both organisms detected in the Eurasian sparrowhawk (Nr. 268C) and the common buzzard (Nr. 683C) positive by *C. psittaci* qPCR shared the highest *ompA* sequence identity with the strain *C. psittaci* Ful127 (Accession number: CP033059.1) with identities of 100% and 99.49%, respectively. This strain had been detected in Northern fulmars (*Fulmarus glacialis*) from the Faroe Islands and belongs to *ompA* genotype A (Herrmann et al. 2006). The *ompA* sequence of four common buzzards (Nr. 511C, 556K, 669C, 671K), the common kestrel (Nr. 311K), and the long-eared owl (Nr. 877K) shared the highest nucleotide identity with *C. psittaci* M56 (Accession number: LS974600.1) with identities ranging from 97.17% to 100%. The remaining common buzzard (Nr. 566C), as well as 22 corvids (Nr. 565C, 621C, 688C, 689C, 690C, 711C, 721C, 735C, 740C, 746C, 751C, 752C, 761C, 772K, 798K, 814C, 826C, 850K, 856C, 858C, 861K, 972C) harbored a chlamydial species that shared the highest *ompA* sequence identity with *C. abortus* strain 15-58d/44 (Accession number: KX870484.1), *C. psittaci* isolate 15-58D/43 (Accession number: KX424658.1), and *C. abortus* strain 15-58d44 (Accession number: LS974600.1) with identities ranging from 99.17% to 100%. All three strains are classified within the provisional *ompA* genotype 1V. The *ompA* sequence of the sample of one carrion crow (Nr. 736C) shared the highest sequence similarity with *C. psittaci* isolate nier_A113.6N (Accession number: KX603696.1), *C. psittaci* isolate nier_A97.6N (Accession number: KX603693.1), and *C. psittaci* isolate 6N (Accession number: EF197829.1), all belonging to the provisional *ompA* genotype 6N with identities of 100%, 99.84%, and 98.44%, respectively. Furthermore, chlamydial organisms sharing the highest *ompA* sequence similarity with *C. psittaci* NJ1 (Accession number: CP003798.1), belonging to *ompA* genotype D, were detected in three carrion crows (Nr. 706C, 716K, 848C). Identities ranged from 96.83% to 97.08%. Results of the *ompA* sequencing are shown in Table 8. In Figure 2, an *ompA* based Neighbor Joining dendrogram is shown. Two obtained *ompA* sequences (752C, 877K) were not included in the dendrogram due to poor sequence quality.

Table 7. Sequence length, sequence quality, first hit by nucleotide identity when compared against the NCBI database and accession number of outer membrane protein A (*ompA*) sequences generated in this study from nine raptors and 26 corvids from Switzerland.

Sample Nr.	Species name (English)	Sequence length (bp)	Sequence quality (%)	First hit	Nucleotide identity (%)	Accession number
268C	Eurasian sparrowhawk	1080	97.0	*C. psittaci* Ful127	99.91	MT450242
311K	Common kestrel	687	93.1	*C. psittaci* M56	99.56	MT450243
511C	Common buzzard	978	67.2	*C. psittaci* M56	100	MT450244
556K	Common buzzard	1116	97.2	*C. psittaci* M56	100	MT450245
565C	Carrion crow	1041	97.5	*C. abortus* 15-58d44	99.43	MT450246
566C	Common buzzard	1080	96.3	*C. abortus* 15-58d44	99.35	MT450247
621C	Rook	1083	97.7	*C. abortus* 15-58d44	99.26	MT450248
669C	Common buzzard	1011	98.1	*C. psittaci* M56	100	MT450249
671K	Common buzzard	933	86.4	*C. psittaci* M56	100	MT450250
683C	Common buzzard	975	71.0	*C. psittaci* Ful127	99.49	MT450251
688C	Carrion crow	1005	97.9	*C. abortus* 15-58d44	99.60	MT450252
689C	Carrion crow	1080	97.8	*C. abortus* 15-58d44	99.26	MT450253
690C	Carrion crow	972	96.8	*C. abortus* 15-58d44	99.9	MT450254
706C	Carrion crow	912	98.3	*C. psittaci* NJ1	96.83	MT450255
711C	Carrion crow	960	95.1	*C. abortus* 15-58d44	99.58	MT450256

716K	Carrion crow	1026	98.1	*C. psittaci* NJ1	97.08	MT450257
721C	Carrion crow	957	99.6	*C. abortus* 15-58d44	99.17	MT450258
735C	Carrion crow	975	99.3	*C. abortus* 15-58d44	99.39	MT450259
736C	Carrion crow	642	97.8	*C. psittaci* nier_A113.6N	100	MT450260
740C	Carrion crow	1008	98.1	*C. abortus* 15-58d44	99.9	MT450261
746C	Carrion crow	1026	98.9	*C. abortus* 15-58d44	99.61	MT450262
751C	Carrion crow	1038	98.8	*C. abortus* 15-58d44	99.23	MT450263
752C	Carrion crow	357	82.2	*C. abortus* 15-58d44	100	MT450264
761C	Carrion crow	954	100	*C. abortus* 15-58d44	99.58	MT450265
772K	Carrion crow	1026	98.5	*C. abortus* 15-58d44	99.61	MT450266
798K	Carrion crow	1038	97.1	*C. abortus* 15-58d44	99.33	MT450267
814C	Carrion crow	1050	98.8	*C. abortus* 15-58d44	99.62	MT450268
826C	Carrion crow	1083	89.4	*C. abortus* 15-58d44	99.54	MT450269
848C	Carrion crow	1023	96.4	*C. psittaci* NJ1	97.07	MT450270
850K	Carrion crow	966	100	*C. abortus* 15-58d44	99.59	MT450271
856C	Carrion crow	942	98.4	*C. abortus* 15-58d44	99.43	MT450272
858C	Carrion crow	966	98.5	*C. abortus* 15-58d44	99.59	MT450273
861K	Carrion crow	1065	98.1	*C. abortus* 15-58d44	99.53	MT450274
877K	Long-eared owl	390	97.2	*C. psittaci* M56	97.17	MT450275
972C	Carrion crow	996	97.8	*C. abortus* 15-58d44	99.60	MT450276

Table 8. Identified outer membrane protein A (*ompA*) genotype of *Chlamydiaceae* detected in nine raptors and 26 crows originating from various Swiss cantons.

Sample Nr.	Species name (English)	Age category	Canton of origin	Year of sampling	Mean CT value *Chlamydiaceae* qPCR	*ompA* genotype
268C	Eurasian sparrowhawk	Adult	Unknown	2018	26.3	A
311K	Common kestrel	Adult	Unknown	2018	26.8	M56
511C	Common buzzard	Adult	Unknown	2019	38.3	M56
556K	Common buzzard	Adult	Zurich	2019	30.7	M56
565C	Carrion crow	Adult	Aargau	2019	27.9	1V
566C	Common buzzard	Adult	Obwalden	2019	29.8	1V
621C	Rook	Juvenile	Unknown	2019	23.9	1V
669C	Common buzzard	Adult	Unknown	2019	27.9	M56
671K	Common buzzard	Adult	Thurgau	2019	27.1	M56
683C	Common buzzard	Unknown	Unknown	2019	33.3	A
688C	Carrion crow	Unknown	Zurich	2019	28.2	1V
689C	Carrion crow	Unknown	Zurich	2019	26.8	1V
690C	Carrion crow	Unknown	Zurich	2019	29.4	1V
706C	Carrion crow	Unknown	Zurich	2019	30.2	D
711C	Carrion crow	Adult	Bern	2019	31.6	1V
716K	Carrion crow	Adult	Bern	2019	30.6	D
721C	Carrion crow	Adult	Zurich	2019	29.9	1V
735C	Carrion crow	Unknown	Zug	2019	28.4	1V
736C	Carrion crow	Unknown	Zug	2019	28.7	6N
740C	Carrion crow	Unknown	Zug	2019	27.7	1V
746C	Carrion crow	Unknown	Zug	2019	24.9	1V
751C	Carrion crow	Unknown	Zug	2019	20.2	1V
752C	Carrion crow	Unknown	Zug	2019	30.4	1V
761C	Carrion crow	Unknown	Zug	2019	29.7	1V
772K	Carrion crow	Unknown	Zug	2019	26.8	1V
798K	Carrion crow	Adult	Zurich	2019	26.7	1V
814C	Carrion crow	Adult	Zurich	2019	25.6	1V
826C	Carrion crow	Adult	Zurich	2019	29.3	1V
848C	Carrion crow	Unknown	Zurich	2019	26.6	D
850K	Carrion crow	Adult	Zurich	2019	27.9	1V

856C	Carrion crow	Unknown	Zurich	2019	29.3	1V
858C	Carrion crow	Adult	Zurich	2019	27.8	1V
861K	Carrion crow	Adult	Unknown	2019	23.6	1V
877K	Long-eared owl	Juvenile	Bern	2019	31.3	M56
972C	Carrion crow	Adult	Fribourg	2019	27.4	1V

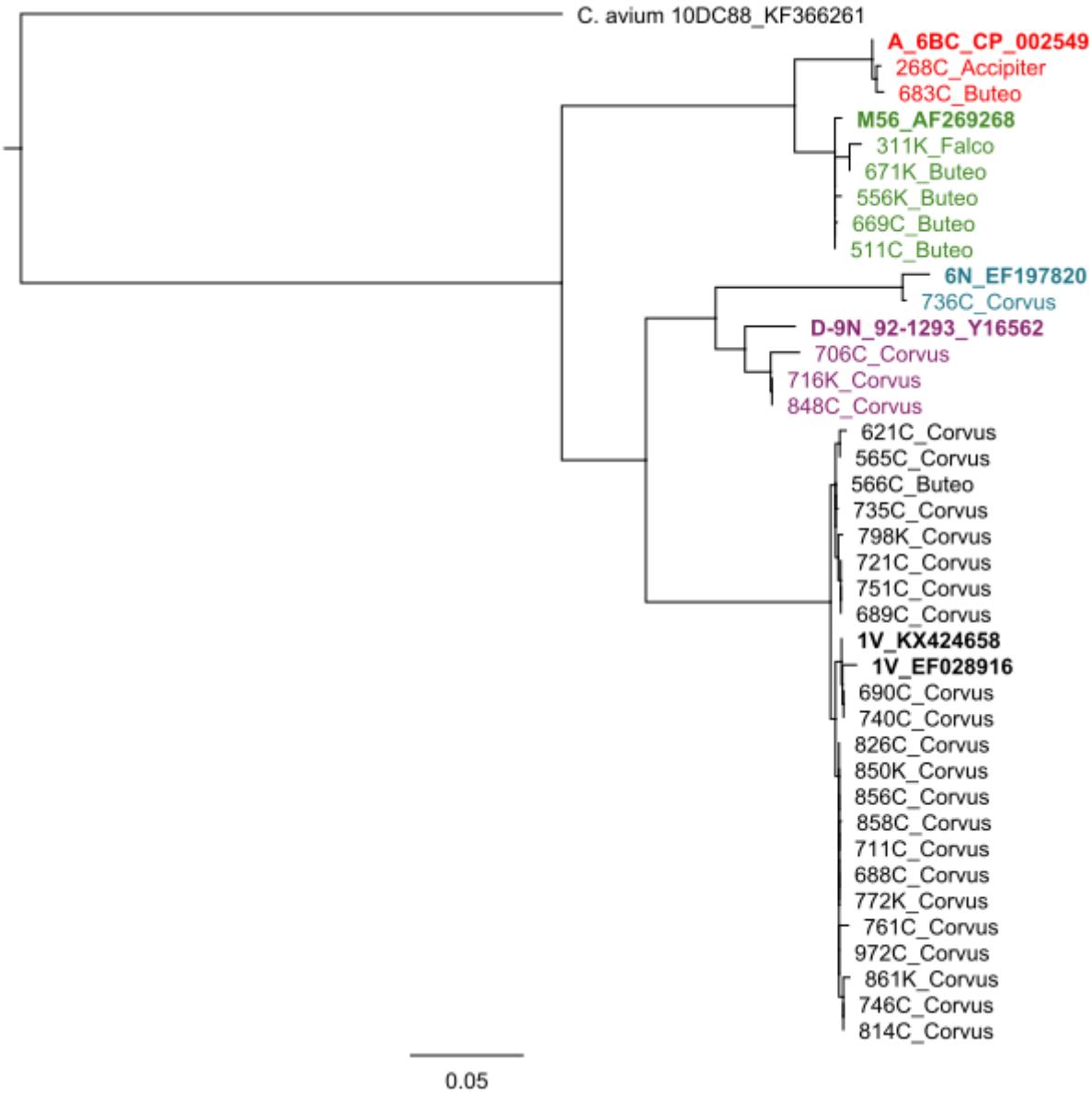

Figure 2. Outer membrane protein A (*ompA*) based Neighbor Joining dendrogram of *Chlamydiaceae* from raptors and corvids from Switzerland. Representative sequences from various *C. psittaci* genotypes are included in boldface. Designation of study isolates correspond to Table 8.

5. Discussion

5.1 Corvids

A total of 23.7% (n = 60) corvids were positive for *Chlamydiaceae* by qPCR in this study. This is in accordance with the findings of Di Francesco et al. (2015), who detected *Chlamydiaceae* in 28.9% (n = 22) of the corvids sampled. However, none of these 60 corvids were positive by the *C. psittaci*-specific qPCR. *C. psittaci* is a common species in Psittaciformes and Columbiformes, but the findings of the current study suggest that it is a rare pathogen in corvids which is supported by previous studies. For example, in the above-mentioned study (Di Francesco et al. 2015), *C. psittaci* was the responsible species in only one of the 22 *Chlamydiaceae* positive corvids. In the 21 others, *C. suis* was detected. Szymańska-Czerwińska et al. (2017) reported similar findings in their study as they could identify *C. psittaci* in two *Chlamydiaceae* positive corvids, whereas eight were classified as avian *C. abortus* and seven could not be further classified.
All chlamydial sequences detected in corvids in this study showed a high 16S rRNA sequence identity with three *C. psittaci* and two *C. abortus* strains detected in corvids from South Korea and Poland, respectively. One of them, *C. psittaci* nier A113, belongs to the provisional *ompA* genotype 6N while the other four strains belong to the provisional genotype 1V (Szymańska-Czerwińska et al. 2017; Jeong et al. 2017). Both genotypes have so far exclusively been detected in corvids. Jeong et al. (2017) reported that the 16S sequences from *C. psittaci* nier-A97, -A101, and -A113 were identical and showed 99.8% sequence identity with that of *C. psittaci* strain Prk46 (Accession number: AB001809.1), which represents a variant intermediate between *C. psittaci* and *C. abortus*. Sequencing of the *ompA* gene confirmed that the organisms detected are closely related to these strains and belong to the provisional *ompA* genotype 1V in 22 cases and 6N in one case, both of which are considered as intermediate variants between *C. psittaci* and *C. abortus* (Yatsentyuk and Obukhov 2007). In three carrion crows *C. psittaci* genotype D was detected, a genotype that is most commonly found in turkeys (Dickx et al. 2010).
In the species-specific qPCR for the recently described species *C. buteonis*, all corvid samples were negative. Therefore, it remains unknown whether this species is able to infect corvids or not.

5.1.1 Magpies

All 30 magpies were negative for *Chlamydiaceae* by qPCR. In contrast, other studies reported *Chlamydiaceae* prevalence in magpies higher than in hooded crows (Di Francesco et al. 2015; Szymańska-Czerwińska et al. 2017). However, several reasons might explain the fact that all magpies in this study were negative. An exceptionally high number of the magpies tested were nestlings or juveniles (21/30). Konicek et al. (2016) reported, that the *Chlamydiaceae* prevalence in their study was significantly lower in juvenile wild birds than in adults ($p < 0.01$). This phenomenon was also observed in corvids in this study. Furthermore, only fecal swabs were available from 14/30 magpies. Andersen (1996) and Guo et al. (2016) reported that *Chlamydiaceae* are significantly more likely to be detected in choanal, compared to cloacal or fecal swabs. The results of this study support their findings. Also, sampling of only one site minimizes the chance to detect *Chlamydiaceae*. Regarding the origin of the magpies, 18/30 of them originated from the canton Lucerne, where the overall *Chlamydiaceae* detection rate was significantly lower than in the other cantons. In contrast, no magpie was obtained from Zug, the canton with the highest detection rate and only three magpies from Zurich, the second canton with a significantly higher *Chlamydiaceae* detection rate. But two

of them were juveniles and only fecal swabs were available of these two. Additionally, only a small number of magpies was available in this study, therefore the significance of our findings has to be rated with caution. The small number might have led to an underestimation of the real *Chlamydiaceae* infection rate in magpies in this study.

5.1.2 Carrion Crow

In total, 28.5% (n = 59) of the carrion crows were positive for *Chlamydiaceae*. This is in accordance with previously performed studies in other European countries (Di Francesco et al. 2015; Szymańska-Czerwińska et al. 2017). The most frequently detected species was *C. psittaci ompA* genotype 1V, a genotype which seems to primarily infect corvids, as it has so far only been detected in this bird family (Jeong et al. 2017; Szymańska-Czerwińska et al. 2017).

5.1.3 Rook

Only a small number of rooks was available in this study (n = 3) as rooks are not widespread in Switzerland with 5'800-7'300 breeding pairs (Vogelwarte Sempach 2020). One rook was positive for *Chlamydiaceae*, translating into a detection rate of 33.3%. The identified species was *C. psittaci ompA* genotype 1V, the same genotype that was also most frequently detected in carrion crows.

5.2 Raptors

In total, 20 raptors (5.9%) were positive for *Chlamydiaceae*. In the literature, a wide range of prevalences (1.3-74.4%) has been reported for *Chlamydiaceae* in European raptors (Gerbermann and Korbel 1993; Schettler et al. 2003; Blomqvist et al. 2012). The detection rate found in this study was in the lower range and is in accordance with the study of Konicek et al. (2016) as they also found 5.9% of the raptors positive for *Chlamydiaceae* in Austria by qPCR. Two studies performed in the neighboring country Germany reported higher prevalences with 13.2% and 74.4% in the southern and eastern part of the country by antigen ELISA and nested PCR, respectively. However, the significance of the 74.4% has to be put in perspective as they only tested a small number of birds (n = 39) for *Chlamydiaceae* (Gerbermann and Korbel 1993; Schettler et al. 2003).
Regarding the three orders of raptors, no significant differences in the *Chlamydiaceae* detection rate could be observed. Although members of the Accipitriformes (7.9%) showed a considerably higher detection rate than members of the Falconiformes (1.4%) this difference was not statistically significant (p = 0.050). This is in accordance with the few other related studies (Blomqvist et al. 2012; Liu et al. 2019). Another study investigating the seroprevalence of various infectious agents in free living birds of prey observed no difference between the *C. psittaci* seroprevalence in Accipitriformes, Falconiformes, and Strigiformes (Schettler et al. 2001).
ompA analysis of both *C. psittaci*-positive raptors revealed genotype A sharing high nucleotide identity with *C. psittaci* Ful127. Although *C. psittaci* could be detected in only two (10.0%) of the *Chlamydiaceae* positive raptors by *C. psittaci*-specific qPCR, 16S rRNA sequencing and *ompA* genotyping showed that *C. psittaci* was the most prevalent species in raptors. In seven birds *C. psittaci* M56 was identified, a mammalian strain typically found in muskrats and hares (Pannekoek et al. 2010). None of the *C. psittaci* M56 positive samples were detected by the *C. psittaci*-specific qPCR in this study. The *C. psittaci*-specific qPCR by Pantchev et al. (2009) used in this study has weaknesses in detecting *C. psittaci* M56 as already noticed by others (Sachse K., personal communication). These raptors presumably got

infected through their prey, as this strain is usually found in mammals and it was detected only in raptors during this study. *ompA* genotyping revealed that one common buzzard harbored *C. psittaci* provisional genotype 1V, a genotype intermediate between *C. psittaci* and *C. abortus* that has so far only been identified in corvids (Jeong et al. 2017; Szymańska-Czerwińska et al. 2017). Despite the fact that around 16.9% of the pigeons in Switzerland harbor *C. psittaci* with *ompA* genotype B as the most prevalent and pigeons are potential prey of several raptors included in this study (e.g. red kite, common buzzard, Eurasian sparrowhawk), it seems not to be transmitted to the raptors (Mattmann et al. 2019). Unfortunately, in half of the *Chlamydiaceae* positive raptors (n = 10), the responsible species could not be determined due to the small amount of bacterial DNA in the sample. All samples were negative for *C. buteonis* by qPCR in this study. Therefore, it remains unknown whether this recently described species does occur in raptors in Switzerland.

5.2.1 Common buzzard

Common buzzards are the most widespread raptors in Switzerland with 15'000-20'000 breeding pairs (Vogelwarte Sempach 2020). Common buzzards showed one of the highest detection rates among all raptor species included in this study with 9.2% (n = 13). The most frequently detected *Chlamydia* species was *C. psittaci* M56, which is considered to be a mammalian strain (Pannekoek et al. 2010). However, the findings of the current study suggest that raptors also harbor this genotype. In one common buzzard *C. psittaci ompA* genotype 1V was identified. This is the first time this genotype was detected in a bird not belonging to the Corvidae family.

5.2.2 Other raptors

The highest detection rate among the raptors was found in Eurasian sparrowhawks with 9.4% (n = 3). In one case the chlamydial species was identified as *C. psittaci* Ful127, belonging to *ompA* genotype A. One common kestrel and one long-eared owl harbored *C. psittaci* M56. This genotype was therefore detected in all three raptor orders included in this study.

5.3 Geographical distribution

Marked differences between the *Chlamydiaceae* detection rates were found depending on the regional origin of the birds. In the cantons Zug (52.9%) and Zurich (24.2%), the detection rate was significantly higher when compared to Lucerne (1.7%) and the other cantons tested ($p < 0.01$). Two other studies that tested potential prey bird species from these areas had similar findings (Zweifel et al. 2009; Mattmann et al. 2019). Zweifel et al. (2009) reported a *Chlamydiaceae* prevalence of 3.3% in feral pigeons from Lucerne and 41.7% in feral pigeons from Zurich. Mattmann et al. (2019) found a prevalence of 17.4% in pigeons from Lucerne and 27.5% in pigeons from Zurich. Mattmann et al. (2019) explained the difference between the prevalences of these two areas with the fact that culling of pigeons, as performed in Zurich, leads to an increased contact rate of individual pigeons due to frequent restructuring of the population and therefore the transmission of pathogens might be increased. In Lucerne on the other hand, different population management programs, including city lofts, are in use.

5.4 Swab types

In the current study, 13.9% (n = 72) of the swabs of the choanal cleft were positive for *Chlamydiaceae*, whereas only 8.8% (n = 46) of the cloacal, and 1.1% (n = 1) of the fecal swabs were positive. Swabs of the choana detected significantly more *Chlamydiaceae*

positive birds than cloacal swabs ($p < 0.01$). Because all three swab types were available from only 23 birds and only two of them were *Chlamydiaceae* positive (both positive at the choana only), a comparison between fecal swabs and the other swab types could not be performed due to lack of data. In other studies, the same findings were observed in farmed chickens, ducks, geese, pigeons, turkeys, and cockatiels (Andersen 1996; Guo et al. 2016; Čechová et al. 2018). Andersen (1996) also reported that swabs from the choanal cleft yielded more positive results compared to cloacal swabs and feces. Moreover, that study observed that at the early stage of infection, only the choanal swabs were positive. Therefore, it is the first site to harbor *Chlamydiae*. In later stages of the infection, the bacteria can be also detected in cloacal swabs and fecal samples. Interestingy, the respiratory tract seems to be the last organ system to clear the infection (Vanrompay et al. 1994). One study investigating the pathogenicity of different *C. psittaci* strains in chickens, found that the overall pharyngeal excretion was slightly higher than the cloacal excretion (Yin et al. 2013). Although pharyngeal and cloacal shedding of *C. psittaci* both started on day two after infection in their study, pharyngeal excretion was significantly higher than cloacal excretion in the early stage of infection (2-6 dpi), while the excretion of the two sites was similar at mid infection (8-17 dpi). These authors (Yin et al. 2013) also reported, that the excretion varies, depending on the *C. psittaci* strain involved. These findings suggest that the respiratory tract plays a major role in the infection and transmission of *Chlamydiae* (Van Buuren et al. 1994). Regarding the 79 *Chlamydiaceae* positive birds where both choanal and cloacal swabs were available, *Chlamydiaceae* were detected in both swabs from 39 (49.4%) birds. In 33 birds (41.8%) only the choanal swab was positive whereas in 7 (8.9%) birds, *Chlamydiaceae* were detected only in the cloacal swab. The findings of this study highlight the importance of using choanal swabs as a clinical specimen for the laboratory detection of *Chlamydiaceae*. Although the choanal swabs have a higher sensitivity, some birds were negative in the choanal but positive in the cloacal swab as the site of shedding depends on the stage of infection. Thus, for clinical sampling, it can be suggested to take both, choanal and cloacal swabs for the detection of *Chlamydiaceae*, since both are relatively easily accessible.

5.5 Age

The exact age was known for only very few birds tested, therefore age estimates were made based on exterior features leading to the rough differentiation between juveniles and adults. Nevertheless, a significant difference of the *Chlamydiaceae* detection rate was noted. In total, a significantly higher detection rate was found in birds considered to be adults (12.3%) compared to juvenile birds (2.5%) ($p < 0.01$). However, this observation was not shared if only raptors were considered. Although the detection rate was clearly higher in adult (8.2%) than in juvenile (2.6%) raptors, the difference was not statistically significant ($p = 0.24$), considering that there was only a small number of juvenile raptors available in this study ($n = 39$).

The findings in this study are consistent with the study of Konicek et al. (2016), as they also found a significantly higher prevalence in adult wild birds (12.2%) compared to juveniles (7.5%). Moreover, two studies from China found that the *C. psittaci* seroprevalence in adult psittacine birds (12.4%) and domestic geese (31.8%) was significantly higher than that of juvenile psittacines (4.8%) and domestic geese (18.4%), respectively (Cong et al. 2014; Zhao et al. 2015). In contrast, there are also several studies with opposite findings. Tolba et al. (2019) reported a significantly higher *C. psittaci* prevalence in psittacine birds less than one-year-old (90.2%) than in psittacines older than one year of age (32.9%) in Egypt. The same result was found by Origlia et al. (2019) in Argentina where prevalence of 40.4% in psittacines younger than one year of age was detected by qPCR, whereas the prevalence in psittacines older than one year of age was only 18.6%. Zhang et al. (2015) reported *C. psittaci*

seroprevalence of 45.7%, 28.0%, and 32.1% in Chinese pet parrots younger than five months, 6-12 months, and 13-18 months of age, respectively. However, these studies were performed in birds that were held in captivity. Therefore, the results may not apply for wild birds as pet birds are kept in a much higher density and therefore the likelihood of transmission to juvenile birds is increased.

5.6 Public health concerns

The zoonotic potential of *C. psittaci* and *C. abortus* is well-known. For other chlamydial species harbored by birds, zoonotic transmission is suspected (e.g. *C. gallinacea* (Laroucau et al. 2009)) or unknown (e.g. *C. avium* (Sachse et al. 2014), *C. pecorum* (Cheong et al. 2019), *C. buteonis* (Laroucau et al. 2019)). *C. psittaci* is the most well-known zoonotic species of the *Chlamydiaceae* family and all genotypes are considered zoonotic, including *C. psittaci* M56 (Beeckman and Vanrompay 2009; Bavoil et al. 2013; Heddema et al. 2015; Carlier et al. 2014; Radomski et al. 2016). Since the awareness of psittacosis is low among the general public and clinicians, it remains most likely underdiagnosed and might occur more often than the reported case numbers indicate (Spoorenberg et al. 2016; Hogerwerf et al. 2017; De Gier et al. 2018; Rybarczyk et al. 2020).
There are still sporadic outbreaks of psittacosis. In 2002, there was a psittacosis outbreak in the Blue Mountains, New South Wales, Australia, with 95 suspected cases with community-acquired pneumonia over a four-month period (Telfer et al. 2005). From January to April 2013, 25 people from southern Sweden were diagnosed with psittacosis. Nineteen of them were hospitalized and one had a fatal outcome (Rehn et al. 2013). Wild birds were thought to be the source of infection in both outbreaks (Telfer et al. 2005; Chereau et al. 2018).
C. psittaci Ful127, which was detected in two raptors in this study, is thought to be the responsible agent for a psittacosis outbreak on the Faroe Islands in the 1930s. Humans contracted *C. psittaci* when they caught juvenile fulmars and prepared them for cooking (Haagen and Maurer 1938). During this outbreak 174 human cases were reported and a death rate of 20% was observed. In pregnant women the death rate was even 80% (Herrmann et al. 2006).
These examples show that *C. psittaci* outbreaks are still a possible threat to human health. Humans with an increased risk for psittacosis include those that come into close contact with birds on a regular basis (e.g. workers in a zoo or in pet shops, veterinarians, veterinary assistants and pet bird owners) (Filstein et al. 1981; Schlossberg et al. 1993; Davies and Collins 1995; Gosbell et al. 1999; Saito et al. 2005; Raso et al. 2010). These persons should take appropriate safety and hygiene measures when handling wild birds. A study showed that bird handlers applying simple measures like wearing protective gloves and washing their hands after handling birds were less likely to get infected by *C. psittaci* (Tolba et al. 2019).

6. Conclusion

In the current study, we examined the occurrence of *Chlamydiaceae* in Swiss raptors and corvids with a special focus on intermediate variants between *C. psittaci* and *C. abortus* and the recently described species *C. buteonis*. In corvids, a *Chlamydiaceae* prevalence of 23.7% was observed and the most frequently observed *ompA* genotype was 1V representing an intermediate variant between *C. psittaci* and *C. abortus*. Raptors showed a prevalence of 5.9%, the most frequently detected species was *C. psittaci* M56, which is most likely transmitted through their prey. *C. buteonis* was not detected in this study. Distinct differences in the occurrence of *Chlamydiaceae* were observed depending on the geographical origin and the age of the birds with adult birds showing a higher detection rate compared to juveniles. Regarding the diagnostics, choanal swabs were a more sensitive method to detect *Chlamydiaceae* than swabs from the cloaca.

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Falcons from the United Arab Emirates infected with *Chlamydia psittaci*/*C. abortus* intermediates specified as *Chlamydia buteonis* by PCR

8. Introduction

The *Chlamydiaceae* family currently comprises a single Genus, *Chlamydia*, with 14 validly published species (Cheong et al. 2019; Laroucau et al. 2019). Members of this family have a wide host range and have been detected in species of mammals, reptiles, birds, and amphibians (Cheong et al. 2019).
Chlamydia (C.) psittaci, the causative agent of chlamydiosis in birds and psittacosis/ornithosis in humans, has been detected in over 460 different avian species of more than 30 orders, including birds from the order Falconiformes (Kaleta and Taday 2003). Several more *Chlamydia* species have been found in birds (to date 10 species and one candidate species): *C. psittaci*, *C. abortus, C. avium, C. gallinacea, C. pecorum, C. buteonis, C. trachomatis, C. suis, C. pneumoniae, C. muridarum,* and *Candidatus* Chlamydia ibidis (Sachse et al. 2012; Vorimore et al. 2013; Di Francesco et al. 2015; Guo et al. 2016; Szymańska-Czerwińska et al. 2017; Laroucau et al. 2019; Stokes et al. 2019). The highest *Chlamydiaceae* prevalence has been observed in birds of the orders Columbiformes and Psittaciformes This suggests that they are an important reservoir not only for *C. psittaci*, but also for other *Chlamydia* species such as *C. abortus* and *C. avium* (Heddema et al. 2006; Vanrompay et al. 2007).
Clinical signs in birds infected with *C. psittaci* are variable, depending on the susceptibility of the host species, the virulence of the causative *C. psittaci* strain and the immune status of the individual, but are mostly characterized by respiratory, ocular, and enteric signs (de Freitas Raso et al. 2006; Harkinezhad et al. 2009). Shedding of the bacteria occurs in diseased birds as well as in asymptomatic carriers and can be intermittently re-activated by stressful events like migration, breeding or other illnesses (Shewen 1980).
Among the *Chlamydiaceae* family, zoonotic transmission is mostly due to *C. psittaci* or *C. abortus* after contact with infected birds and aborting sheep or goats, respectively. However, recent studies suggest that other chlamydial agents, such as *C. caviae* are able to cause atypical pneumonia in humans (Laroucau et al. 2009; Ortega et al. 2016; Ramakers et al. 2017; Van Grootveld et al. 2018). Transmission of *C. psittaci* between birds or from birds to humans occurs through inhalation of feather dust and contaminated aerosols from urine, feces, respiratory or ocular secretions (Beeckman et al. 2009). Concerning other members of the *Chlamydiaceae* family, it is largely unknown whether bird to human transmission does occur (Cheong et al. 2019).
Several studies in birds, among others in falcons, reported the occurrence of atypical *Chlamydia* species that are genetically intermediate between *C. psittaci* and *C. abortus* (Fukushi et al. 1988; Vanrompay et al. 1997; Herrmann et al. 2000; Van Loock et al. 2003; Madani and Peighambari 2013; Aaziz et al. 2015; Krawiec et al. 2015; Luján-Vega et al. 2018; Liu et al. 2019), and are identified as either *C. psittaci* or *C. abortus* by conventional diagnostic methods. One of these “intermediates” was recently described as the new species *C. buteonis* (Laroucau et al. 2019). Initially, *C. buteonis* was detected in a red-tailed hawk (RTH, *Buteo jamaicensis*) in the 1990s, but was classified as *C. psittaci* in cell culture with immunofluorescent staining at that time (Mirandé et al. 1992). More than 10 years later, the genome of this isolate was sequenced, evaluated and determined to be an intermediate strain (Joseph et al. 2015). Recently, together with another isolate from a red-shouldered hawk (RSHA, *Buteo lineatus*), the RTH strain was classified as *C. buteonis* (Laroucau et al. 2019).

Both strains have led to clinical signs of avian chlamydiosis in their host, including conjunctivitis, respiratory distress, and diarrhea (Mirandé et al. 1992; Laroucau et al. 2019). However, only few studies focused on the clinical signs associated with chlamydial infections in raptors, therefore the clinical importance of *C. buteonis* is still unknown (Fowler et al. 1990).
The present study reports the occurrence of *C. buteonis* in gyrfalcons (*Falco rusticolus*) and gyr/peregrine falcon hybrids (*Falco rusticolus x Falco peregrinus*) admitted to clinics in the United Arab Emirates (UAE).

9. Material and Methods

9.1 Samples of falcons and pigeons

Twenty-three falcons and three pigeons were admitted to the Al Aseefa Falcon Hospital, Dubai, UAE and the Al Dhaid veterinary center for falcons, Sharjah, UAE, with similar clinical history (loss of performance, poor general condition including vomiting and diarrhea) or were presented to these clinics for a routine health check. For *Chlamydia* diagnostics, feces were collected from each animal. All 26 fecal samples were shipped to the Institute of Veterinary Pathology at the University of Zurich, Switzerland for further investigation.

9.2 Clinical history of eight falcons

Detailed information about the clinical history was available for five gyrfalcons and three gyr/peregrine falcon hybrids presented to clinics between November 2017 and September 2018 (Table 1).

Table 1. Origin, sex, age, and reason for presentation of five gyrfalcons (*Falco rusticolus*) and three gyr/peregrine falcon hybrids (*Falco rusticolus x Falco peregrinus*) tested in this study. F = female, M = male.

Case Nr.	Falcon species	Origin	Sex	Age	Reason for presentation
4344	gyrfalcon	wild caught	F	> 1 year	health check (no clinical signs)
5949	gyrfalcon	unknown	F	< 1 year	history of being weak
6521	gyr/peregrine falcon hybrid	captive bred	F	< 2 months	history of being weak
6559	gyrfalcon	captive bred	F	< 2 months	history of being weak
6578	gyrfalcon	captive bred	F	< 2 months	history of being weak
6601	gyr/peregrine falcon hybrid	captive bred	F	< 2 months	history of being weak and unable to fly
6948	gyrfalcon	captive bred	F	unknown	vomiting, diarrhea and poor general condition
7010	gyr/peregrine falcon hybrid	captive bred	M	< 1 year	blood, crop and fecal examination (no clinical signs)

Findings of the clinical examination and blood parameters of falcons are shown in Table 2. Reference values for blood parameters in gyrfalcons were adapted according to Samour et al. (2005) and Wernick et al. (2013). Bloodwork revealed moderate anemia in two birds with packed-cell volumes (PCV) ≤ 38% and hemoglobin levels (Hb) ≤ 14.0 (6521, 6601). A mild anemia was detected in three falcons with PCVs of 44% or 47%, and Hb ≤ 16.3 g/dl (6559, 6578, 6948). White blood cells (WBC) count was increased in one bird (6521) with 18.0 $x10^9$/l. In two cases an increase of aspartate aminotransferase (AST) and creatine kinase (CK) was observed (6601, 7010). Increased levels of globulins were observed in five cases (6521, 6559, 6578, 6601, 6948).

Table 2. Clinical findings and blood parameters of eight falcons tested positive for *Chlamydiaceae* by qPCR. Increased values are shown in bold, decreased values are italicized.

Case Nr.	Findings at the clinical examination	Hb (g/dl)	PCV (%)	WBC (x10^9/l)	Total protein (g/l)	AST (U/l)	CK (U/l)	Globulins (g/dl)
4344	mucoid feces	17.3	48	8.0	30			
5949	apathy, mucoid feces	18.4	50	6.6	30			
6521	apathy, mucoid feces with traces of blood	*14.0*	*38*	**18.0**	30	108	1391	**2.0**
6559	apathy, biliverdinuria, mucoid feces	*15.5*	*44*	10.0	30		1236	**1.5**
6578	apathy, mucoid feces	*16.3*	*47*	6.0	30	112	1374	**1.7**
6601	apathy, mucoid feces	*13.6*	*36*	10.4	30	**1395**	**2657**	**1.5**
6948	apathy, mucoid feces	*16.0*	*44*	9.0	30			**1.7**
7010	mucoid feces	19.2	50	6.0	24	**195**	**2790**	

Further diagnostic approaches such as crop swabs, X-rays, endoscopy of the caudal thoracic air sacs, and fecal examination were performed (Table 3). In the crop swab of case no. 7010, a significant amount of *Candida* sp. was detected. Inflammatory cells were observed in the crop swab of falcon no. 6559. Abnormal findings in the X-rays included splenomegaly (5949, 6521, 6559, 6601), hepatomegaly (6521, 6601), gas-filled intestines (6521, 6559, 6601, 6948), and thickened intestinal walls (6521). During endoscopy, few adult *Serratospiculum* sp. worms were observed in the caudal thoracic air sacs in falcon no. 4344, pneumonia and aerosacculitis in falcon no. 6948, and disseminated tiny white spots on the liver surface in cases no. 6521, 6559, and 6601. Fecal examination was performed using a quick Romanowsky staining (Quick III^{TM}, astral diagnostics, West Deptford, NJ, USA) of air-dried fecal smears from all eight birds revealing high amounts of small bacteria with *Chlamydia* morphology. Intracytoplasmic bacteria consistent with chlamydial inclusions were also detected in the cytoplasm of sloughed intestinal epithelial cells. Furthermore, the presence of heterophils and mononuclear cells, as well as increased amount of mucus were observed. Additionally, a *Chlamydia* rapid test device (Dipromed GmbH, Ebreichsdorf, Austria), which is used to detect *C. trachomatis* in humans but is not validated for the use in birds, was positive for the fecal samples of all eight birds.

After the diagnosis of chlamydial infection, all birds were treated with azithromycin, a bacteriostatic macrolide-type antibiotic commonly used to treat chlamydial infections in humans, for 5-10 days either at the clinic or by the owner. All patients fully recovered and were discharged from the clinic after treatment. Birds presented for a follow-up at the clinics did not show any clinical signs and the white spots on the liver surface detected earlier in three falcons were no longer present during endoscopy.

Table 3. Findings of crop swabs, X-rays, and endoscopy of the caudal thoracic air sacs from eight falcons tested positive for *Chlamydiaceae* by real-time PCR (qPCR).

Case Nr.	Crop swab	X-rays	Endoscopy of the caudal thoracic air sacs
4344	physiologic	not done	few adult *Serratospiculum* sp. in the caudal thoracic air sacs
5949	physiologic	splenomegaly	physiologic

6521	not done	hepatosplenomegaly, thick walled, gas filled intestines	mottled liver
6559	inflammatory cells	splenomegaly, gas filled intestines	mottled liver
6578	physiologic	physiologic	physiologic
6601	physiologic	hepatosplenomegaly, gas filled intestines	mottled liver
6948	not done	gas filled intestines	pneumonia, aerosacculitis
7010	*Candida* sp. +++	not done	not done

9.3 Chlamydial species identification

All 26 fecal samples were shipped to Switzerland for further investigation and analyzed by the Institute of Veterinary Pathology and the National Reference Centre for Poultry and Rabbit Diseases at the University of Zurich. In order to identify the chlamydial species involved, DNA was extracted from feces and analyzed using a step-wise approach as previously described (Mattmann et al. 2019): First, a broad-range *Chlamydiaceae* 23S ribosomal RNA (rRNA) real-time PCR (qPCR), followed by a 23S rRNA-based microarray assay, and 16S rRNA conventional PCR and sequencing were performed (Ehricht et al. 2006; Blumer et al. 2007; Borel et al. 2008). In parallel, all samples were investigated with the *C. psittaci*-specific qPCR as well as the newly described *C. buteonis*-specific qPCR (Pantchev et al. 2009; Laroucau et al. 2019). Samples positive by *C. psittaci* qPCR were further subjected to outer membrane protein A (*ompA*)-genotyping (Sachse et al. 2008).

9.4 DNA extraction

DNA of the fecal samples was extracted using a DNeasy Blood and Tissue Kit (Qiagen), following the protocol for tissue samples, with an extended lysis step overnight. Quantity and quality of extracted DNA was measured using a Nanodrop 2000c spectrophotometer (Thermo Fisher Scientific, Waltham, MA, USA) and stored at -20°C until further use.

9.5 *Chlamydiaceae* 23S qPCR

All samples were analyzed with a *Chlamydiaceae* family-specific 23S rRNA-based qPCR, modified to include an internal amplification control (enhanced green fluorescent protein (eGFP)) (Ehricht et al. 2006; Blumer et al. 2011). The reaction mix contained 12.5 µl TaqMan Universal PCR MasterMix, 500 nM of the primers CH23S-F (5'-CTGAAACCAGTAGCTTATAAGCGGT-3') and CH23S-R (5'-ACCTCGCCGTTTAACTTAACTCC-3'), 200 nM of the probe CH23S-P (5' FAM-CTCATCATGCAAAAGGCACGCCG-TAMRA 3'), and 200 nM of the primers eGFP-1-F (5'-GACCACTACCAGCAGAACAC-3'), eGFP-10-R (5'-CTTGTACAGCTCGTCCATGC-3'), and the probe eGFP-HEX (5'-HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1-3') each, in a final volume of 25 µl. Cycle conditions were 95°C for 20 s, followed by 45 cycles of 95°C for 3 s and 60°C for 30 s. All samples were tested in duplicates and the cycle threshold was set at 0.1 in each run. Molecular grade water was used as a negative control and *C. abortus* DNA as positive control. Samples were interpreted as positive if the mean cycle threshold (CT) was < 38. Samples with higher CT values or inhibited amplification were re-tested in duplicate. Samples repeatedly showing a CT value > 38 were considered as positive (Mattmann et al. 2019).

9.6 DNA microarray assay

The sample DNA, including internal control DNA (Intype IC-DNA, Qiagen Labor, Leipzig, Germany), was amplified and biotin labelled using the primers U23F-19 (5'-ATTGAMAGGCGAWGAAGGA-3') and 23R-22 (5'-biotin-GCYTACTAAGATGTTTCAGTTC-3'), including an eGFP internal control with the primers eGFP-11-F (5'-CAGCCACAACGTCTATATCATG-3') and eGFP-10-R-Bio (5'-Bio-CTTGTACAGCTCGTCCATGC-3') as described by Borel et al (2008). The cycle conditions were 96°C for 10 min, followed by 40 cycles of 94°C for 30 s, 50°C for 30 s, and 72°C for 30 s and a last step of 72°C for 4 min. The labeled DNA was hybridized using the Hybridization Kit 245200100 (Alere Technologies GmbH; now Abbott, Chicago, Illinois, USA) and analyzed using the ArrayStrip^{TM} system (ChlamType-23S AS-4 Kit, Alere Technologies GmbH, Jena, Germany), as established by Borel et al. (2008). With the current kit, 11 *Chlamydia* species and nine *Chlamydia*-like organisms can be identified.

9.7 16S rRNA conventional PCR (short)

The conventional short 16S rRNA PCR was performed as described by Blumer et al. (2007), using the primers 16S IGF (short) (5'-GATGAGGCATGCAAGTCGAACG-3') and 16S IGR (short) (5'-CCAGTGTTGGCGGTCAATCTCTC-3') to amplify a sequence of 278 base pairs (bp).
A 50 µl reaction mix, containing 1 µl (< 150 ng/µl) sample template, 1x PCR buffer with $MgCl_2$ (Roche Diagnostics GmbH), 0.5 mM $MgCl_2$ Stock Solution (Roche Diagnostics GmbH), 0.2 nM dNTP (PCR Nucleotide Mix, Roche Diagnostics GmbH), 300 nM of both primers, and 0.02 U/µl FastStart Taq DNA Polymerase was prepared for each sample. Cycling conditions were 95°C for 5 min, followed by 40 cycles of 95°C for 60 s, 65°C for 60 s, and 72°C for 90 s and a final extension of 72°C for 10 min.
Products from all conventional PCRs were purified with the QIAquick® PCR Purification Kit (Qiagen) according to manufacturer's instructions. Purified amplicons were Sanger sequenced by Microsynth (Balgach, Switzerland). The obtained sequences were assembled and analyzed using the Geneious Prime software (version 2019.2.3, https://www.geneious.com) and compared against the NCBI database with the BLASTn tool (NCBI, https://blast.ncbi.nlm.nih.gov/).

9.8 *C. psittaci* qPCR

The *C. psittaci*-specific qPCR by Pantchev et al. (2009) was modified to include an internal control (eGFP) (Hoffmann et al. 2005). All samples were tested in duplicate. The reaction mix contained 4 µl (< 150 ng/µl) sample template, 1 µl eGFP template, 1x TaqMan Universal PCR MasterMix, 900 nM of the primers CppsOMP1-F (5'-CACTATGTGGGAAGGTGCTTCA-3') and CppsOMP1-R (5'-CTGCGCGGATGCTAATGG-3'), 200 nM probe CppsOMP1-S (5'-FAM-CGCTACTTGGTGTGAC-TAMRA-3'), 900 nM of the primers eGFP-1-F (5'-GACCACTACCAGCAGAACAC-3') and eGFP-2-R (5'-GAACTCCAGCAGGACCATG-3'), and 200 nM probe eGFP-HEX (5'-HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1-3') in a final volume of 25 µl.

9.9 *C. buteonis* qPCR

The *C. buteonis*-specific qPCR was performed as previously described by Laroucau et al. 2019, modified to include an internal positive control (eGFP) (Hoffmann et al. 2005). Samples were tested in duplicate. The final mix contained 12.5 µl TaqMan Universal PCR MasterMix, 600 nM of the primers RSHA-F (5'-ATTTCCACACGCACTGCAT-3') and RSHA-R (5'-TGGGACTAGGTGTTCTCCCT-3'), 200 nM probe RSHA-P (5'-FAM-GGACAACATGCCTAGATGAAGA-TAMRA-3'), 400 nM of the primers eGFP-1-F (5'-GACCACTACCAGCAGAACAC-3') and eGFP-2-R (5'-GAACTCCAGCAGGACCATG-3'), 200 nM probe eGFP-HEX (5'-HEX-AGCACCCAGTCCGCCCTGAGCA-BHQ1-3'), 4 µl sample template, and 1 µl eGFP template in a final volume of 25 µl. A negative control (aqua bidest.) and a positive control (DNA of *C. buteonis* RSHA) were used in duplicates. Samples with only one positive duplicate were retested in duplicates. Inconclusive samples (one positive, one negative) in the repeat run were considered as negative.

9.10 *ompA* genotyping

A reaction mix with a final volume of 50 µl containing 25 µl REDTaq ReadyMix (Merck KGaA, Darmstadt, Germany), 200 nM of the primers ompA F (CTU) (5'-ATGAAAAAACTCTTGAAATCGG-3') and ompA rev (5'-TCCTTAGAATCTGAATTGAGC-3'), and 3 µl sample template with a DNA concentration of 25 ng/µl per sample was prepared (Sachse et al. 2008). Cycling conditions were 10 min at 95°C, followed by 35 cycles of 95°C for 30 s, 49°C for 30 s, 72°C for 60 s and a final elongation at 72°C for 7 min. If amplification resulted in weak bands, a modified cycling protocol with 40 cycles of 95°C for 60 s, 49°C for 60 s, and 72°C for 90 s was used. Sequencing and analysis of the obtained sequences was performed as described above.

10. Results

In 21 of the 23 falcons, *Chlamydiaceae* were detected by qPCR. Further classification with the microarray assay as well as 16S rRNA PCR and sequencing was performed, which yielded inconclusive results (Table 4). The microarray assay (including 11 out of 14 currently known *Chlamydia* species) identified in 15 samples *C. abortus*, in one sample *C. suis*, two could not be identified and five samples remained negative. Comparing the obtained 278bp 16S rRNA sequence product against the NCBI database resulted in the classification of 21 samples as *C. psittaci* whereas sequencing was not successful in two samples. Thus, based on these two approaches, 15 samples were considered to be *C. psittaci*/*C. abortus* intermediate species. All tested samples from falcons (n = 20) were negative by the *C. psittaci*-specific qPCR. The *C. psittaci*-specific qPCR was not performed in three samples due to insufficient sample material (Case number: 8963-1C, 8982-2A, 8982-3A). The *C. buteonis*-specific qPCR performed on all 23 samples, however, was positive in 16 of the 21 *Chlamydiaceae* positive samples. In three samples, the PCR was negative (Case number: 7010, 8982-2A, 9051-2B). Results of four samples did not show reproducible positive PCR results and were therefore also considered negative (Case number: 8913-1C, 8913-2B, 8963-1B, 8963-1C). CT values of the *C. buteonis* positive samples ranged between 16.9 and 37.4, the mean CT value was 26.3. Of the 16 *C. buteonis*-positive samples, 12 had been classified as *C. abortus* or *C. abortus/C. psittaci* intermediates by the microarray assay, one had been classified as *C. suis*, one was negative, and two could not be classified. All 16 *C. buteonis*-positive samples were classified as *C. psittaci* by sequencing of the 16S rRNA PCR product.
The samples of the three pigeons were all positive by the *C. psittaci*-specific qPCR with CT values ranging from 17.6 to 27.1 (mean CT value: 22.6) and negative in the *C. buteonis* qPCR (Table 4). This was in accordance with the results of the microarray assay and partial 16S rRNA sequences. The amplified *ompA* sequences of these three pigeon samples shared 100% identity with *C. psittaci* CP3 (Accession number: CP003797.1), thus belonging to *ompA* genotype B. The *ompA* sequences generated in this study are accessible in Genbank under accession numbers MT079834-MT079836.

Table 4. Results of different microbiological tests using a step-wise approach for the detection and identification of *Chlamydia* in 23 falcons and three pigeons from the United Arab Emirates. Case numbers of falcons where clinical information was available are indicated in bold. Results in brackets (Chlamydial species) indicate a weakly positive microarray result, neg = negative, pos = positive, qPCR = real-time PCR.

Case Nr.	Bird species	*Chlamydiaceae* qPCR	Microarray assay	16S rRNA PCR and sequencing	Accession number of 16S rRNA study sequence	*C. psittaci* qPCR	*C. buteonis* qPCR
3784	falcon	pos	*C. abortus*	*C. psittaci*	MT075449	neg	**pos**
4344	gyrfalcon	pos	(*C. abortus*)	*C. psittaci*	MT075450	neg	**pos**
5949	gyrfalcon	pos	(*C. abortus*)	*C. psittaci*	MT075451	neg	**pos**
6521	gyr/peregrine falcon hybrid	pos	not classified	*C. psittaci*	MT075452	neg	**pos**
6559	gyrfalcon	pos	*C. abortus*	*C. psittaci*	MT075453	neg	**pos**
6578	gyrfalcon	pos	not classified	*C. psittaci*	MT075454	neg	**pos**
6601	gyr/peregrine falcon hybrid	pos	*C. abortus*	*C. psittaci*	MT075455	neg	**pos**
6948	gyrfalcon	pos	*C. abortus*	*C. psittaci*	MT075456	neg	**pos**

7010	gyr/peregrine falcon hybrid	pos	*C. abortus*	*C. psittaci*	MT075457	neg	neg
8913-1A	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075461	neg	**pos**
8913-1C	falcon	pos	neg	no sequence		neg	neg
8913-2B	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075462	neg	neg
8913-3B	falcon	pos	*C. suis*	*C. psittaci*	MT075463	neg	**pos**
8913-4B	falcon	pos	*C. abortus*	*C. psittaci*	MT075464	neg	**pos**
8963-1B	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075465	neg	neg
8963-1C	falcon	pos	neg	no sequence		not done[a]	neg
8982-2A	falcon	neg	neg	*C. psittaci*	MT074566	not done[a]	neg
8982-3A	falcon	pos	neg	*C. psittaci*	MT075467	not done[a]	**pos**
9010-1A	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075468	neg	**pos**
9010-3A	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075469	neg	**pos**
9010-3B	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075470	neg	**pos**
9051-2B	falcon	neg	neg	*C. psittaci*	MT075471	neg	neg
No case number	falcon	pos	(*C. abortus*)	*C. psittaci*	MT075472	neg	**pos**
8912-1	pigeon	pos	*C. psittaci*	*C. psittaci*	MT075458	pos	neg
8912-3	pigeon	pos	*C. psittaci*	*C. psittaci*	MT075459	pos	neg
8912-4	pigeon	pos	*C. psittaci*	*C. psittaci*	MT075460	pos	neg

[a]insufficient sample quantity

11. Discussion

The recently described *C. buteonis* has so far only been detected in hawks. This study is the first to report the occurrence of *C. buteonis* in members of the Falconidae family and from the Arabian Peninsula. Sixteen falcons, of which the clinical history was known in seven, tested positive for *C. buteonis*. Six of the seven falcons with a clinical history were presented due to general loss of fitness and one of these showed additional gastrointestinal symptoms (Table 1). Case no. 6948 was diagnosed with pneumonia and aerosacculitis by endoscopy of the caudal thoracic air sacs, while in the six other cases the respiratory tract seemed unaffected. None of the birds showed signs of conjunctivitis. Based on preliminary non-molecular tests, a presumptive diagnosis of chlamydial enteric infection was made. During endoscopy of three birds (6521, 6559, 6601), disseminated tiny white spots suggestive of a chronic bacterial disease were observed on the surface of the liver. Furthermore, in one of these birds (6601), increased AST and CK values were noted, indicating the presence of liver disease, although stress due to handling may also cause such an increase (Bollinger et al. 1989; Cray et al. 2008). It is yet unknown whether *C. buteonis* causes clinical signs in birds, but the observation that six out of seven *C. buteonis* positive birds with known medical history were ill, and that their general fitness improved when receiving antibiotic treatment against chlamydiosis, indicates that *C. buteonis* is pathogenic for falcons. However, it cannot be excluded that other bacterial agents responsive to azithromycin treatment leading to similar clinical presentation were responsible such as *Salmonella enterica* subspecies *enterica* serovar Typhimurium or *Clostridium perfringens*.

For the diagnosis of avian chlamydiosis, state of the art molecular methods are recommended including recently described PCRs to detect new *Chlamydia* species in birds like *C. buteonis*, *C. avium*, and *C. gallinacea* (Zocevic et al. 2013; Guo et al. 2016; Laroucau et al. 2019). In the current study, *Chlamydiaceae* positive samples were subjected to a microarray assay as well as 16S rRNA sequencing for species identification, which led to inconclusive results (Table 4). All samples finally specified as *C. buteonis* were first identified as *C. psittaci* by short 16S rRNA sequencing and most as *C. abortus* by the microarray assay. Before applying the new *C. buteonis* qPCR, they were identified as *C. psittaci*/*C. abortus*-intermediates, as previously described in various bird species (Fukushi et al. 1988; Vanrompay et al. 1997; Herrmann et al. 2000; Van Loock et al. 2003; Madani and Peighambari 2013; Aaziz et al. 2015; Krawiec et al. 2015; Luján-Vega et al. 2018; Liu et al. 2019). In three samples (7010, 8913-2B, and 8963-1B) that were classified as *C. abortus* by microarray assay and as *C. psittaci* by 16S rRNA sequencing (short product), the *C. buteonis*-specific qPCR was negative. Therefore, the responsible *Chlamydia* seems to be a *C. psittaci*/*C. abortus* intermediate species, but not *C. buteonis*, suggesting that falcons harbor intermediate species other than *C. buteonis*.

The fecal samples of the three pigeons were sent to Zurich together with those of the falcons, but unfortunately, no information about the relationship between the pigeons and the falcons was available. All three pigeons harbored *C. psittaci* genotype B but remained negative for *C. buteonis*, therefore it remains unknown whether *C. buteonis* is able to infect pigeons or not. It is known that *C. psittaci*, especially genotype B, is the predominant chlamydial species in pigeons and that pigeons are among the avian hosts with the highest prevalences of *Chlamydia* (Magnino et al. 2009; Gasparini et al. 2011; Sachse et al. 2012; Dolz et al. 2013; Wang et al. 2018). It is therefore not surprising that *C. psittaci*, *ompA* genotype B, was identified in the three pigeons in this study.

The current study shows that *C. buteonis* is able to infect falcons. Furthermore, the clinical histories of the infected birds in this study indicate that *C. buteonis* is probably pathogenic for falcons. However, more studies are needed to confirm these preliminary findings. The

zoonotic potential of *C. buteonis* and its distribution in the wild bird population remains unknown as very limited information about this species is available yet and further research must be performed to evaluate its impact on human and avian health.

12. References

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13. Supplementary material

Supplementary table 1. Details on origin and analysis results of all swab samples collected and processed in the frame of the present study.
(neg. = negative, pos. = positive, n.d. = not determined, N/A = not applicable)

Sample	Species name (English)	Species name (Latin)	Age	Place of origin	Canton	Material	*Chlamydiaceae* qPCR (Ø CT value)	*C. psittaci* qPCR (Ø CT value)	*C. buteonis* qPCR	Final classification
8C	Tawny owl	*Strix aluco*	Adult		LU	Choana	neg.	n.d.	n.d.	N/A
8K	Tawny owl	*Strix aluco*	Adult		LU	Cloaca	neg.	n.d.	n.d.	N/A
8Kot	Tawny owl	*Strix aluco*	Adult		LU	Feces	neg.	n.d.	n.d.	N/A
11C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	6028 Herlisberg	LU	Choana	neg.	n.d.	n.d.	N/A
11K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	6028 Herlisberg	LU	Cloaca	neg.	n.d.	n.d.	N/A
12C	Common buzzard	*Buteo buteo*	Adult	6210 Sursee	LU	Choana	neg.	n.d.	n.d.	N/A
12K	Common buzzard	*Buteo buteo*	Adult	6210 Sursee	LU	Cloaca	neg.	n.d.	n.d.	N/A
13C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
13K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
14C	Common buzzard	*Buteo buteo*		6000 Luzern	LU	Choana	pos. (32.7)	neg.	neg.	*C. psittaci* M56
14K	Common buzzard	*Buteo buteo*		6000 Luzern	LU	Cloaca	pos. (29.4)	neg.	neg.	Not identified
15C	Barn owl	*Tyto alba*	Adult	3114 Wichtrach	BE	Choana	neg.	n.d.	n.d.	N/A
15K	Barn owl	*Tyto alba*	Adult	3114 Wichtrach	BE	Cloaca	pos. (36.3)	neg.	neg.	Not identified
16C	Tawny owl	*Strix aluco*	Adult	6130 Willisau	LU	Choana	neg.	n.d.	n.d.	N/A
16K	Tawny owl	*Strix aluco*	Adult	6130 Willisau	LU	Cloaca	neg.	n.d.	n.d.	N/A
17C	Red kite	*Milvus milvus*	Adult	6289 Hämikon	LU	Choana	neg.	n.d.	n.d.	N/A
17K	Red kite	*Milvus milvus*	Adult	6289 Hämikon	LU	Cloaca	neg.	n.d.	n.d.	N/A
18C	Common kestrel	*Falco tinnunculus*	Adult	6246 Altishofen	LU	Choana	neg.	n.d.	n.d.	N/A
18K	Common kestrel	*Falco tinnunculus*	Adult	6246 Altishofen	LU	Cloaca	neg.	n.d.	n.d.	N/A
19C	Common buzzard	*Buteo buteo*	Adult	6244 Nebikon	LU	Choana	neg.	n.d.	n.d.	N/A
19K	Common buzzard	*Buteo buteo*	Adult	6244 Nebikon	LU	Cloaca	neg.	n.d.	n.d.	N/A

35Kot	Carrion crow	*Corvus corone*				Feces	neg.	n.d.	n.d.	N/A
55Kot	Eurasian magpie	*Pica pica*		5727 Oberkulm	AG	Feces	neg.	n.d.	n.d.	N/A
58C	Common buzzard	*Buteo buteo*	Adult	6032 Emmen	LU	Choana	neg.	n.d.	n.d.	N/A
58K	Common buzzard	*Buteo buteo*	Adult	6032 Emmen	LU	Cloaca	neg.	n.d.	n.d.	N/A
60Kot	Black kite	*Milvus migrans*	Adult	6032 Emmen	LU	Feces	neg.	n.d.	n.d.	N/A
68C	Red kite	*Milvus milvus*	Adult	6017 Ruswil	LU	Choana	neg.	n.d.	n.d.	N/A
68K	Red kite	*Milvus milvus*	Adult	6017 Ruswil	LU	Cloaca	neg.	n.d.	n.d.	N/A
102Kot	Eurasian magpie	*Pica pica*	Juvenile	5623 Boswil	AG	Feces	neg.	n.d.	n.d.	N/A
103Kot	Eurasian magpie	*Pica pica*	Juvenile	5623 Boswil	AG	Feces	neg.	n.d.	n.d.	N/A
105Kot	Carrion crow	*Corvus corone*	Juvenile	6203 Sempach-Station	LU	Feces	neg.	n.d.	n.d.	N/A
106Kot	Carrion crow	*Corvus corone*	Juvenile	6033 Buchrain	LU	Feces	neg.	n.d.	n.d.	N/A
126C	Carrion crow	*Corvus corone*	Juvenile	6210 Sursee	LU	Choana	neg.	n.d.	n.d.	N/A
126K	Carrion crow	*Corvus corone*	Juvenile	6210 Sursee	LU	Cloaca	neg.	n.d.	n.d.	N/A
132C	Long-eared owl	*Asio otus*	Adult	6213 Knutwil	LU	Choana	neg.	n.d.	n.d.	N/A
132K	Long-eared owl	*Asio otus*	Adult	6213 Knutwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
160C	Eurasian jay	*Garrulus glandarius*	Adult	6204 Sempach	LU	Choana	neg.	n.d.	n.d.	N/A
160K	Eurasian jay	*Garrulus glandarius*	Adult	6204 Sempach	LU	Cloaca	neg.	n.d.	n.d.	N/A
160Kot	Eurasian jay	*Garrulus glandarius*	Adult	6204 Sempach	LU	Feces	neg.	n.d.	n.d.	N/A
163C	Eurasian magpie	*Pica pica*	Juvenile	6032 Emmen	LU	Choana	neg.	n.d.	n.d.	N/A
163K	Eurasian magpie	*Pica pica*	Juvenile	6032 Emmen	LU	Cloaca	neg.	n.d.	n.d.	N/A
163Kot	Eurasian magpie	*Pica pica*	Juvenile	6032 Emmen	LU	Feces	neg.	n.d.	n.d.	N/A
166Kot	Carrion crow	*Corvus corone*	Juvenile	6252 Dagmersellen	LU	Feces	neg.	n.d.	n.d.	N/A
167Kot	Carrion crow	*Corvus corone*	Juvenile	6216 Mauensee	LU	Feces	neg.	n.d.	n.d.	N/A
176Kot	Eurasian magpie	*Pica pica*	Juvenile	8157 Oberglatt	ZH	Feces	neg.	n.d.	n.d.	N/A
178C	Carrion crow	*Corvus corone*	Juvenile	6005 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
178K	Carrion crow	*Corvus corone*	Juvenile	6005 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
178Kot	Carrion crow	*Corvus corone*	Juvenile	6005 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A

179Kot	Eurasian magpie	*Pica pica*	Juvenile	6003 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
199C	Carrion crow	*Corvus corone*	Juvenile	6000 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
199K	Carrion crow	*Corvus corone*	Juvenile	6000 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
209Kot	Carrion crow	*Corvus corone*	Juvenile	6206 Neuenkirch	LU	Feces	neg.	n.d.	n.d.	N/A
213C	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Choana	neg.	n.d.	n.d.	N/A
213K	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Cloaca	neg.	n.d.	n.d.	N/A
214C	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Choana	neg.	n.d.	n.d.	N/A
214K	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Cloaca	neg.	n.d.	n.d.	N/A
215C	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Choana	neg.	n.d.	n.d.	N/A
215K	Carrion crow	*Corvus corone*	Juvenile	6010 Kriens	LU	Cloaca	neg.	n.d.	n.d.	N/A
218Kot	Common kestrel	*Falco tinnunculus*	Juvenile	6294 Ermensee	LU	Feces	neg.	n.d.	n.d.	N/A
223Kot	Common kestrel	*Falco tinnunculus*	Juvenile	6289 Hämikon	LU	Feces	neg.	n.d.	n.d.	N/A
228C	Long-eared owl	*Asio otus*	Juvenile	6280 Hochdorf	LU	Choana	neg.	n.d.	n.d.	N/A
228K	Long-eared owl	*Asio otus*	Juvenile	6280 Hochdorf	LU	Cloaca	neg.	n.d.	n.d.	N/A
231Kot	Long-eared owl	*Asio otus*	Adult	6280 Hochdorf	LU	Feces	neg.	n.d.	n.d.	N/A
237Kot	Black kite	*Milvus migrans*	Juvenile	6017 Ruswil	LU	Feces	neg.	n.d.	n.d.	N/A
241C	Eurasian magpie	*Pica pica*	Juvenile	6036 Dierikon	LU	Choana	neg.	n.d.	n.d.	N/A
241K	Eurasian magpie	*Pica pica*	Juvenile	6036 Dierikon	LU	Cloaca	neg.	n.d.	n.d.	N/A
241Kot	Eurasian magpie	*Pica pica*	Juvenile	6036 Dierikon	LU	Feces	neg.	n.d.	n.d.	N/A
246Kot	Common kestrel	*Falco tinnunculus*	Juvenile	6032 Emmen	LU	Feces	neg.	n.d.	n.d.	N/A
248C	Common kestrel	*Falco tinnunculus*	Adult	3032 Hinterkappelen	BE	Choana	neg.	n.d.	n.d.	N/A
248K	Common kestrel	*Falco tinnunculus*	Adult	3032 Hinterkappelen	BE	Cloaca	neg.	n.d.	n.d.	N/A
255C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
255K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
256C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
256K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
257C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A

257K	Common buzzard	*Buteo buteo*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
258C	Common buzzard	*Buteo buteo*	Adult	Choana	neg.	n.d.	n.d.	N/A
258K	Common buzzard	*Buteo buteo*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
259C	Tawny owl	*Strix aluco*	Adult	Choana	neg.	n.d.	n.d.	N/A
259K	Tawny owl	*Strix aluco*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
260C	Long-eared owl	*Asio otus*	Adult	Choana	neg.	n.d.	n.d.	N/A
260K	Long-eared owl	*Asio otus*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
261C	Common kestrel	*Falco tinnunculus*	Adult	Choana	neg.	n.d.	n.d.	N/A
261K	Common kestrel	*Falco tinnunculus*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
262C	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	Choana	neg.	n.d.	n.d.	N/A
262K	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	Cloaca	neg.	n.d.	n.d.	N/A
263C	Common buzzard	*Buteo buteo*	Adult	Choana	neg.	n.d.	n.d.	N/A
263K	Common buzzard	*Buteo buteo*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
264C	Eurasian hobby	*Falco subbuteo*		Choana	neg.	n.d.	n.d.	N/A
264K	Eurasian hobby	*Falco subbuteo*		Cloaca	neg.	n.d.	n.d.	N/A
265C	Barn owl	*Tyto alba*	Adult	Choana	neg.	n.d.	n.d.	N/A
265K	Barn owl	*Tyto alba*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
266C	Red kite	*Milvus milvus*	Adult	Choana	neg.	n.d.	n.d.	N/A
266K	Red kite	*Milvus milvus*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
267C	Common kestrel	*Falco tinnunculus*	Adult	Choana	neg.	n.d.	n.d.	N/A
267K	Common kestrel	*Falco tinnunculus*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
268C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	Choana	pos. (26.3)	pos. (24.9)	neg.	*C. psittaci* A
268K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
269C	Common buzzard	*Buteo buteo*	Adult	Choana	neg.	n.d.	n.d.	N/A
269K	Common buzzard	*Buteo buteo*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
270C	Common buzzard	*Buteo buteo*	Adult	Choana	neg.	n.d.	n.d.	N/A
270K	Common buzzard	*Buteo buteo*	Adult	Cloaca	neg.	n.d.	n.d.	N/A
271C	Red kite	*Milvus milvus*	Adult	Choana	neg.	n.d.	n.d.	N/A

271K	Red kite	*Milvus milvus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
272C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
272K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
273C	Red kite	*Milvus milvus*	Adult			Choana	neg.	n.d.	n.d.	N/A
273K	Red kite	*Milvus milvus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
274C	Red kite	*Milvus milvus*	Adult	4566 Halten	SO	Choana	neg.	n.d.	n.d.	N/A
274K	Red kite	*Milvus milvus*	Adult	4566 Halten	SO	Cloaca	neg.	n.d.	n.d.	N/A
275C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	2545 Seuzach	SO	Choana	neg.	n.d.	n.d.	N/A
275K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	2545 Seuzach	SO	Cloaca	neg.	n.d.	n.d.	N/A
276C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3000 Bern	BE	Choana	neg.	n.d.	n.d.	N/A
276K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3000 Bern	BE	Cloaca	neg.	n.d.	n.d.	N/A
277C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3255 Rapperswil	BE	Choana	neg.	n.d.	n.d.	N/A
277K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3255 Rapperswil	BE	Cloaca	neg.	n.d.	n.d.	N/A
278C	Tawny owl	*Strix aluco*	Adult	4704 Wolfisberg	BE	Choana	neg.	n.d.	n.d.	N/A
278K	Tawny owl	*Strix aluco*	Adult	4704 Wolfisberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
279C	Tawny owl	*Strix aluco*	Adult			Choana	neg.	n.d.	n.d.	N/A
279K	Tawny owl	*Strix aluco*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
280C	Tawny owl	*Strix aluco*	Adult			Choana	neg.	n.d.	n.d.	N/A
280K	Tawny owl	*Strix aluco*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
281C	Tawny owl	*Strix aluco*	Adult	8805 Richterswil	ZH	Choana	neg.	n.d.	n.d.	N/A
281K	Tawny owl	*Strix aluco*	Adult	8805 Richterswil	ZH	Cloaca	neg.	n.d.	n.d.	N/A
282C	Barn owl	*Tyto alba*	Adult			Choana	neg.	n.d.	n.d.	N/A
282K	Barn owl	*Tyto alba*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
283C	Barn owl	*Tyto alba*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
283K	Barn owl	*Tyto alba*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
284C	Barn owl	*Tyto alba*	Juvenile	3257 Ammerzwil	BE	Choana	neg.	n.d.	n.d.	N/A
284K	Barn owl	*Tyto alba*	Juvenile	3257 Ammerzwil	BE	Cloaca	neg.	n.d.	n.d.	N/A
285C	Long-eared owl	*Asio otus*	Adult	3454 Sumiswald	BE	Choana	neg.	n.d.	n.d.	N/A

285K	Long-eared owl	*Asio otus*	Adult	3454 Sumiswald	BE	Cloaca	neg.	n.d.	n.d.	N/A
286C	Barn owl	*Tyto alba*	Adult	4460 Gelterkinden	BL	Choana	neg.	n.d.	n.d.	N/A
286K	Barn owl	*Tyto alba*	Adult	4460 Gelterkinden	BL	Cloaca	neg.	n.d.	n.d.	N/A
287C	Barn owl	*Tyto alba*	Adult			Choana	neg.	n.d.	n.d.	N/A
287K	Barn owl	*Tyto alba*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
288C	Long-eared owl	*Asio otus*	Adult			Choana	neg.	n.d.	n.d.	N/A
288K	Long-eared owl	*Asio otus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
289C	Barn owl	*Tyto alba*	Adult			Choana	neg.	n.d.	n.d.	N/A
289K	Barn owl	*Tyto alba*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
293Kot	Common kestrel	*Falco tinnunculus*	Adult			Feces	neg.	n.d.	n.d.	N/A
294Kot	Common kestrel	*Falco tinnunculus*	Adult			Feces	neg.	n.d.	n.d.	N/A
295Kot	Common kestrel	*Falco tinnunculus*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
296Kot	Common kestrel	*Falco tinnunculus*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
297Kot	Common buzzard	*Buteo buteo*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
298C	Common kestrel	*Falco tinnunculus*	Adult	3294 Büren a.A.	BE	Choana	neg.	n.d.	n.d.	N/A
298K	Common kestrel	*Falco tinnunculus*	Adult	3294 Büren a.A.	BE	Cloaca	neg.	n.d.	n.d.	N/A
299C	Common kestrel	*Falco tinnunculus*	Adult	4710 Balsthal	SO	Choana	neg.	n.d.	n.d.	N/A
299K	Common kestrel	*Falco tinnunculus*	Adult	4710 Balsthal	SO	Cloaca	neg.	n.d.	n.d.	N/A
300C	Common kestrel	*Falco tinnunculus*	Juvenile	3315 Bätterkinden	BE	Choana	neg.	n.d.	n.d.	N/A
300K	Common kestrel	*Falco tinnunculus*	Juvenile	3315 Bätterkinden	BE	Cloaca	neg.	n.d.	n.d.	N/A
301C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
301K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
302C	Common kestrel	*Falco tinnunculus*	Adult	4566 Oekingen	SO	Choana	neg.	n.d.	n.d.	N/A
302K	Common kestrel	*Falco tinnunculus*	Adult	4566 Oekingen	SO	Cloaca	neg.	n.d.	n.d.	N/A
303C	Common kestrel	*Falco tinnunculus*	Adult	3303 Jegenstorf	BE	Choana	neg.	n.d.	n.d.	N/A
303K	Common kestrel	*Falco tinnunculus*	Adult	3303 Jegenstorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
304C	Common kestrel	*Falco tinnunculus*	Adult	3427 Utzenstorf	BE	Choana	neg.	n.d.	n.d.	N/A
304K	Common kestrel	*Falco tinnunculus*	Adult	3427 Utzenstorf	BE	Cloaca	neg.	n.d.	n.d.	N/A

305C	Common kestrel	*Falco tinnunculus*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
305K	Common kestrel	*Falco tinnunculus*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
306C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
306K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
307C	Common kestrel	*Falco tinnunculus*	Adult	3305 Scheunen	BE	Choana	neg.	n.d.	n.d.	N/A
307K	Common kestrel	*Falco tinnunculus*	Adult	3305 Scheunen	BE	Cloaca	neg.	n.d.	n.d.	N/A
308C	Common kestrel	*Falco tinnunculus*	Adult	3314 Schalunen	BE	Choana	neg.	n.d.	n.d.	N/A
308K	Common kestrel	*Falco tinnunculus*	Adult	3314 Schalunen	BE	Cloaca	neg.	n.d.	n.d.	N/A
309C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
309K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
310C	Common kestrel	*Falco tinnunculus*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
310K	Common kestrel	*Falco tinnunculus*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
311C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
311K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	pos. (26.8)	neg.	neg.	*C. psittaci* M56
312C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
312K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
313C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
313K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
314C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
314K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
315C	Common kestrel	*Falco tinnunculus*	Adult	4704 Wolfisberg	BE	Choana	neg.	n.d.	n.d.	N/A
315K	Common kestrel	*Falco tinnunculus*	Adult	4704 Wolfisberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
316C	Common kestrel	*Falco tinnunculus*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
316K	Common kestrel	*Falco tinnunculus*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
317C	Red kite	*Milvus milvus*	Adult			Choana	neg.	n.d.	n.d.	N/A
317K	Red kite	*Milvus milvus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
318C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
318K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A

319C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
319K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
320C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
320K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
321C	Tawny owl	*Strix aluco*	Adult			Choana	neg.	n.d.	n.d.	N/A
321K	Tawny owl	*Strix aluco*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
323C	Eurasian magpie	*Pica pica*	Juvenile	6234 Triengen	LU	Choana	neg.	n.d.	n.d.	N/A
323K	Eurasian magpie	*Pica pica*	Juvenile	6234 Triengen	LU	Cloaca	neg.	n.d.	n.d.	N/A
329Kot	Common buzzard	*Buteo buteo*	Adult			Feces	neg.	n.d.	n.d.	N/A
330Kot	Common kestrel	*Falco tinnunculus*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
339C	Common kestrel	*Falco tinnunculus*	Juvenile	8918 Unterlunkhofen	AG	Choana	neg.	n.d.	n.d.	N/A
339K	Common kestrel	*Falco tinnunculus*	Juvenile	8918 Unterlunkhofen	AG	Cloaca	neg.	n.d.	n.d.	N/A
339Kot	Common kestrel	*Falco tinnunculus*	Juvenile	8918 Unterlunkhofen	AG	Feces	neg.	n.d.	n.d.	N/A
348C	Carrion crow	*Corvus corone*	Juvenile	4802 Strengelbach	AG	Choana	neg.	n.d.	n.d.	N/A
348K	Carrion crow	*Corvus corone*	Juvenile	4802 Strengelbach	AG	Cloaca	neg.	n.d.	n.d.	N/A
371C	Common kestrel	*Falco tinnunculus*	Juvenile	8903 Birmensdorf	AG	Choana	neg.	n.d.	n.d.	N/A
371K	Common kestrel	*Falco tinnunculus*	Juvenile	8903 Birmensdorf	AG	Cloaca	neg.	n.d.	n.d.	N/A
373Kot	Carrion crow	*Corvus corone*	Juvenile	6216 Mauensee	LU	Feces	neg.	n.d.	n.d.	N/A
377C	Common kestrel	*Falco tinnunculus*	Adult	6074 Giswil	OW	Choana	neg.	n.d.	n.d.	N/A
377K	Common kestrel	*Falco tinnunculus*	Adult	6074 Giswil	OW	Cloaca	neg.	n.d.	n.d.	N/A
378C	Common buzzard	*Buteo buteo*		6062 Oberwilen	OW	Choana	neg.	n.d.	n.d.	N/A
378K	Common buzzard	*Buteo buteo*		6062 Oberwilen	OW	Cloaca	neg.	n.d.	n.d.	N/A
379Kot	Eurasian hobby	*Falco subbuteo*	Juvenile	4450 Sissach	BL	Feces	neg.	n.d.	n.d.	N/A
381C	Red kite	*Milvus milvus*	Juvenile	6045 Meggen	LU	Choana	neg.	n.d.	n.d.	N/A
381K	Red kite	*Milvus milvus*	Juvenile	6045 Meggen	LU	Cloaca	neg.	n.d.	n.d.	N/A
382C	Eurasian magpie	*Pica pica*	Juvenile	6204 Sempach	LU	Choana	neg.	n.d.	n.d.	N/A

382K	Eurasian magpie	*Pica pica*	Juvenile	6204 Sempach	LU	Cloaca	neg.	n.d.	n.d.	N/A
383Kot	Common buzzard	*Buteo buteo*	Juvenile	5643 Sins	AG	Feces	neg.	n.d.	n.d.	N/A
385Kot	Red kite	*Milvus milvus*	Adult	5632 Buttwil	AG	Feces	neg.	n.d.	n.d.	N/A
388C	Eurasian magpie	*Pica pica*	Juvenile	6284 Sulz	LU	Choana	neg.	n.d.	n.d.	N/A
388K	Eurasian magpie	*Pica pica*	Juvenile	6284 Sulz	LU	Cloaca	neg.	n.d.	n.d.	N/A
388Kot	Eurasian magpie	*Pica pica*	Juvenile	6284 Sulz	LU	Feces	neg.	n.d.	n.d.	N/A
402C	Black kite	*Milvus migrans*	Adult	6122 Menznau	LU	Choana	neg.	n.d.	n.d.	N/A
402K	Black kite	*Milvus migrans*	Adult	6122 Menznau	LU	Cloaca	neg.	n.d.	n.d.	N/A
402Kot	Black kite	*Milvus migrans*	Adult	6122 Menznau	LU	Feces	neg.	n.d.	n.d.	N/A
412Kot	Eurasian magpie	*Pica pica*	Juvenile	6038 Gisikon	OW	Feces	neg.	n.d.	n.d.	N/A
425C	Tawny owl	*Strix aluco*	Adult	5728 Gontenschwil	AG	Choana	neg.	n.d.	n.d.	N/A
425K	Tawny owl	*Strix aluco*	Adult	5728 Gontenschwil	AG	Cloaca	neg.	n.d.	n.d.	N/A
425Kot	Tawny owl	*Strix aluco*	Adult	5728 Gontenschwil	AG	Feces	neg.	n.d.	n.d.	N/A
443C	Eurasian eagle-owl	*Asio otus*	Juvenile	6126 Daiwil	LU	Choana	neg.	n.d.	n.d.	N/A
443K	Eurasian eagle-owl	*Asio otus*	Juvenile	6126 Daiwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
452C	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6476 Altdorf	UR	Choana	neg.	n.d.	n.d.	N/A
452K	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6476 Altdorf	UR	Cloaca	neg.	n.d.	n.d.	N/A
452Kot	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6476 Altdorf	UR	Feces	neg.	n.d.	n.d.	N/A
454C	Common buzzard	*Buteo buteo*	Adult	6234 Triengen	LU	Choana	neg.	n.d.	n.d.	N/A
454K	Common buzzard	*Buteo buteo*	Adult	6234 Triengen	LU	Cloaca	neg.	n.d.	n.d.	N/A
460C	Barn owl	*Tyto alba*	Juvenile	6203 Sempach-Station	LU	Choana	neg.	n.d.	n.d.	N/A
460K	Barn owl	*Tyto alba*	Juvenile	6203 Sempach-Station	LU	Cloaca	neg.	n.d.	n.d.	N/A
472C	Barn owl	*Tyto alba*		1678 Siviriez	FR	Choana	neg.	n.d.	n.d.	N/A
472K	Barn owl	*Tyto alba*		1678 Siviriez	FR	Cloaca	neg.	n.d.	n.d.	N/A
473C	Red kite	*Milvus milvus*	Juvenile	5728 Gontenschwil	AG	Choana	neg.	n.d.	n.d.	N/A
473K	Red kite	*Milvus milvus*	Juvenile	5728 Gontenschwil	AG	Cloaca	neg.	n.d.	n.d.	N/A
474C	Tawny owl	*Strix aluco*		6276 Hohenrain	LU	Choana	neg.	n.d.	n.d.	N/A

474K	Tawny owl	*Strix aluco*		6276 Hohenrain	LU	Cloaca	neg.	n.d.	n.d.	N/A
476C	Black kite	*Milvus migrans*	Juvenile	6032 Emmen	LU	Choana	neg.	n.d.	n.d.	N/A
476K	Black kite	*Milvus migrans*	Juvenile	6032 Emmen	LU	Cloaca	neg.	n.d.	n.d.	N/A
477C	Barn owl	*Tyto alba*		6204 Sempach	LU	Choana	neg.	n.d.	n.d.	N/A
477K	Barn owl	*Tyto alba*		6204 Sempach	LU	Cloaca	neg.	n.d.	n.d.	N/A
478C	Common buzzard	*Buteo buteo*	Adult	6234 Schlierbach	LU	Choana	neg.	n.d.	n.d.	N/A
478K	Common buzzard	*Buteo buteo*	Adult	6234 Schlierbach	LU	Cloaca	neg.	n.d.	n.d.	N/A
479C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	4805 Brittnau	AG	Choana	neg.	n.d.	n.d.	N/A
479K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	4805 Brittnau	AG	Cloaca	neg.	n.d.	n.d.	N/A
480C	Barn owl	*Tyto alba*		5645 Fenkrieden	AG	Choana	neg.	n.d.	n.d.	N/A
480K	Barn owl	*Tyto alba*		5645 Fenkrieden	AG	Cloaca	neg.	n.d.	n.d.	N/A
481C	Common kestrel	*Falco tinnunculus*	Juvenile	6023 Rothenburg	LU	Choana	neg.	n.d.	n.d.	N/A
481K	Common kestrel	*Falco tinnunculus*	Juvenile	6023 Rothenburg	LU	Cloaca	neg.	n.d.	n.d.	N/A
482C	Common kestrel	*Falco tinnunculus*	Juvenile	6055 Alpnach	OW	Choana	neg.	n.d.	n.d.	N/A
482K	Common kestrel	*Falco tinnunculus*	Juvenile	6055 Alpnach	OW	Cloaca	neg.	n.d.	n.d.	N/A
483C	Montagu's harrier	*Circus pygargus*	Juvenile	3860 Meiringen	BE	Choana	neg.	n.d.	n.d.	N/A
483K	Montagu's harrier	*Circus pygargus*	Juvenile	3860 Meiringen	BE	Cloaca	neg.	n.d.	n.d.	N/A
484C	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6212 St. Erhard	LU	Choana	neg.	n.d.	n.d.	N/A
484K	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6212 St. Erhard	LU	Cloaca	neg.	n.d.	n.d.	N/A
485C	Common kestrel	*Falco tinnunculus*		6205 Eich	LU	Choana	neg.	n.d.	n.d.	N/A
485K	Common kestrel	*Falco tinnunculus*		6205 Eich	LU	Cloaca	neg.	n.d.	n.d.	N/A
486C	Eurasian magpie	*Pica pica*		6383 Dallenwil	NW	Choana	neg.	n.d.	n.d.	N/A
486K	Eurasian magpie	*Pica pica*		6383 Dallenwil	NW	Cloaca	neg.	n.d.	n.d.	N/A
487Kot	Carrion crow	*Corvus corone*	Adult	6032 Emmen	LU	Feces	pos. (36.2)	neg.	neg.	Not identified
488C	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6210 Sursee	LU	Choana	neg.	n.d.	n.d.	N/A
488K	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile	6210 Sursee	LU	Cloaca	neg.	n.d.	n.d.	N/A
489C	Common buzzard	*Buteo buteo*	Adult	6026 Rain	LU	Choana	neg.	n.d.	n.d.	N/A
489K	Common buzzard	*Buteo buteo*	Adult	6026 Rain	LU	Cloaca	neg.	n.d.	n.d.	N/A

490C	Carrion crow	*Corvus corone*	Juvenile	6014 Littau	LU	Choana	neg.	n.d.	n.d.	N/A
490K	Carrion crow	*Corvus corone*	Juvenile	6014 Littau	LU	Cloaca	neg.	n.d.	n.d.	N/A
491C	Common buzzard	*Buteo buteo*	Adult	6204 Sempach	LU	Choana	neg.	n.d.	n.d.	N/A
491K	Common buzzard	*Buteo buteo*	Adult	6204 Sempach	LU	Cloaca	neg.	n.d.	n.d.	N/A
492C	Eurasian jay	*Garrulus glandarius*		4125 Riehen	BL	Choana	neg.	n.d.	n.d.	N/A
492K	Eurasian jay	*Garrulus glandarius*		4125 Riehen	BL	Cloaca	neg.	n.d.	n.d.	N/A
493C	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
493K	Eurasian sparrowhawk	*Accipiter nisus*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
494C	Common buzzard	*Buteo buteo*		8500 Frauenfeld	TG	Choana	neg.	n.d.	n.d.	N/A
494K	Common buzzard	*Buteo buteo*		8500 Frauenfeld	TG	Cloaca	neg.	n.d.	n.d.	N/A
495C	Common buzzard	*Buteo buteo*	Adult	8804 Wädenswil	ZH	Choana	neg.	n.d.	n.d.	N/A
495K	Common buzzard	*Buteo buteo*	Adult	8804 Wädenswil	ZH	Cloaca	neg.	n.d.	n.d.	N/A
496C	Common buzzard	*Buteo buteo*	Adult	8262 Ramsen	SH	Choana	neg.	n.d.	n.d.	N/A
496K	Common buzzard	*Buteo buteo*	Adult	8262 Ramsen	SH	Cloaca	neg.	n.d.	n.d.	N/A
497C	Common buzzard	*Buteo buteo*	Adult	8001 Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
497K	Common buzzard	*Buteo buteo*	Adult	8001 Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
498C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
498K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
499C	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Choana	neg.	n.d.	n.d.	N/A
499K	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Cloaca	neg.	n.d.	n.d.	N/A
500C	Common buzzard	*Buteo buteo*	Adult	8254 Basadingen	TG	Choana	neg.	n.d.	n.d.	N/A
500K	Common buzzard	*Buteo buteo*	Adult	8254 Basadingen	TG	Cloaca	neg.	n.d.	n.d.	N/A
501C	Common buzzard	*Buteo buteo*	Adult	8400 Winterthur	ZH	Choana	neg.	n.d.	n.d.	N/A
501K	Common buzzard	*Buteo buteo*	Adult	8400 Winterthur	ZH	Cloaca	neg.	n.d.	n.d.	N/A
502C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
502K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
503C	Common buzzard	*Buteo buteo*	Adult	6344 Meierskappel	LU	Choana	neg.	n.d.	n.d.	N/A
503K	Common buzzard	*Buteo buteo*	Adult	6344 Meierskappel	LU	Cloaca	neg.	n.d.	n.d.	N/A

504C	Common buzzard	*Buteo buteo*	Adult	6032 Emmen	LU	Choana	neg.	n.d.	n.d.	N/A
504K	Common buzzard	*Buteo buteo*	Adult	6032 Emmen	LU	Cloaca	neg.	n.d.	n.d.	N/A
505C	Common buzzard	*Buteo buteo*	Adult	5467 Fisibach	AG	Choana	neg.	n.d.	n.d.	N/A
505K	Common buzzard	*Buteo buteo*	Adult	5467 Fisibach	AG	Cloaca	neg.	n.d.	n.d.	N/A
506C	Common buzzard	*Buteo buteo*	Adult	8422 Pfungen	ZH	Choana	neg.	n.d.	n.d.	N/A
506K	Common buzzard	*Buteo buteo*	Adult	8422 Pfungen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
507C	Common buzzard	*Buteo buteo*	Adult	8590 Romanshorn	TG	Choana	neg.	n.d.	n.d.	N/A
507K	Common buzzard	*Buteo buteo*	Adult	8590 Romanshorn	TG	Cloaca	neg.	n.d.	n.d.	N/A
508C	Common buzzard	*Buteo buteo*	Adult	8058 Flughafen-Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
508K	Common buzzard	*Buteo buteo*	Adult	8058 Flughafen-Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
509C	Common buzzard	*Buteo buteo*	Adult	8340 Hinwil	ZH	Choana	neg.	n.d.	n.d.	N/A
509K	Common buzzard	*Buteo buteo*	Adult	8340 Hinwil	ZH	Cloaca	neg.	n.d.	n.d.	N/A
510C	Common buzzard	*Buteo buteo*	Adult	8488 Turbenthal	ZH	Choana	neg.	n.d.	n.d.	N/A
510K	Common buzzard	*Buteo buteo*	Adult	8488 Turbenthal	ZH	Cloaca	neg.	n.d.	n.d.	N/A
511C	Common buzzard	*Buteo buteo*	Adult			Choana	pos. (38.3)	neg.	neg.	*C. psittaci* M56
511K	Common buzzard	*Buteo buteo*	Adult			Cloaca	pos. (35.2)	neg.	neg.	Not identified
512C	Common buzzard	*Buteo buteo*		8185 Winkel	ZH	Choana	neg.	n.d.	n.d.	N/A
512K	Common buzzard	*Buteo buteo*		8185 Winkel	ZH	Cloaca	neg.	n.d.	n.d.	N/A
513C	Red kite	*Milvus milvus*		8700 Küsnacht	ZH	Choana	neg.	n.d.	n.d.	N/A
513K	Red kite	*Milvus milvus*		8700 Küsnacht	ZH	Cloaca	neg.	n.d.	n.d.	N/A
514C	Common buzzard	*Buteo buteo*		8046 Zürich Affoltern	ZH	Choana	neg.	n.d.	n.d.	N/A
514K	Common buzzard	*Buteo buteo*		8046 Zürich Affoltern	ZH	Cloaca	neg.	n.d.	n.d.	N/A
515C	Common buzzard	*Buteo buteo*	Adult	8460 Marthalen	ZH	Choana	neg.	n.d.	n.d.	N/A
515K	Common buzzard	*Buteo buteo*	Adult	8460 Marthalen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
516C	Common buzzard	*Buteo buteo*	Adult	8610 Uster	ZH	Choana	neg.	n.d.	n.d.	N/A
516K	Common buzzard	*Buteo buteo*	Adult	8610 Uster	ZH	Cloaca	neg.	n.d.	n.d.	N/A

517C	Common buzzard	*Buteo buteo*	Adult	8535 Herdern	TG	Choana	neg.	n.d.	n.d.	N/A
517K	Common buzzard	*Buteo buteo*	Adult	8535 Herdern	TG	Cloaca	neg.	n.d.	n.d.	N/A
518C	Common buzzard	*Buteo buteo*	Adult	8460 Marthalen	ZH	Choana	neg.	n.d.	n.d.	N/A
518K	Common buzzard	*Buteo buteo*	Adult	8460 Marthalen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
519C	Common buzzard	*Buteo buteo*	Adult	9400 Rorschach	SG	Choana	neg.	n.d.	n.d.	N/A
519K	Common buzzard	*Buteo buteo*	Adult	9400 Rorschach	SG	Cloaca	neg.	n.d.	n.d.	N/A
520C	Common buzzard	*Buteo buteo*	Adult		ZH	Choana	neg.	n.d.	n.d.	N/A
520K	Common buzzard	*Buteo buteo*	Adult		ZH	Cloaca	neg.	n.d.	n.d.	N/A
521C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8409 Winterthur	ZH	Choana	neg.	n.d.	n.d.	N/A
521K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8409 Winterthur	ZH	Cloaca	neg.	n.d.	n.d.	N/A
522C	Common buzzard	*Buteo buteo*	Adult	8902 Urdorf	ZH	Choana	neg.	n.d.	n.d.	N/A
522K	Common buzzard	*Buteo buteo*	Adult	8902 Urdorf	ZH	Cloaca	neg.	n.d.	n.d.	N/A
523C	Common buzzard	*Buteo buteo*		8315 Tagelswangen	ZH	Choana	neg.	n.d.	n.d.	N/A
523K	Common buzzard	*Buteo buteo*		8315 Tagelswangen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
524C	Common kestrel	*Falco tinnunculus*		8196 Wil (Rafz)	ZH	Choana	neg.	n.d.	n.d.	N/A
524K	Common kestrel	*Falco tinnunculus*		8196 Wil (Rafz)	ZH	Cloaca	neg.	n.d.	n.d.	N/A
525C	Carrion crow	*Corvus corone*	Adult	6174 Sörenberg	LU	Choana	neg.	n.d.	n.d.	N/A
525K	Carrion crow	*Corvus corone*	Adult	6174 Sörenberg	LU	Cloaca	neg.	n.d.	n.d.	N/A
526C	Common buzzard	*Buteo buteo*	Adult	5225 Bözberg	AG	Choana	neg.	n.d.	n.d.	N/A
526K	Common buzzard	*Buteo buteo*	Adult	5225 Bözberg	AG	Cloaca	neg.	n.d.	n.d.	N/A
527Kot	Common buzzard	*Buteo buteo*	Adult	5712 Beinwil am See	AG	Feces	neg.	n.d.	n.d.	N/A
528Kot	Common buzzard	*Buteo buteo*	Adult	6000 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
529C	Common buzzard	*Buteo buteo*	Adult	6252 Dagmersellen	LU	Choana	neg.	n.d.	n.d.	N/A
529K	Common buzzard	*Buteo buteo*	Adult	6252 Dagmersellen	LU	Cloaca	neg.	n.d.	n.d.	N/A
530Kot	Common buzzard	*Buteo buteo*	Adult	6204 Sempach	LU	Feces	neg.	n.d.	n.d.	N/A
531Kot	Common buzzard	*Buteo buteo*	Adult	6333 Hünenberg	ZG	Feces	neg.	n.d.	n.d.	N/A
532C	Common buzzard	*Buteo buteo*	Adult	6025 Neudorf	LU	Choana	neg.	n.d.	n.d.	N/A

532K	Common buzzard	*Buteo buteo*	Adult	6025 Neudorf	LU	Cloaca	neg.	n.d.	n.d.	N/A
533C	Common buzzard	*Buteo buteo*	Adult	6023 Rothenburg	LU	Choana	neg.	n.d.	n.d.	N/A
533K	Common buzzard	*Buteo buteo*	Adult	6023 Rothenburg	LU	Cloaca	neg.	n.d.	n.d.	N/A
534C	Common buzzard	*Buteo buteo*		8187 Weiach	ZH	Choana	neg.	n.d.	n.d.	N/A
534K	Common buzzard	*Buteo buteo*		8187 Weiach	ZH	Cloaca	neg.	n.d.	n.d.	N/A
535C	Common buzzard	*Buteo buteo*		9548 Matzingen	TG	Choana	neg.	n.d.	n.d.	N/A
535K	Common buzzard	*Buteo buteo*		9548 Matzingen	TG	Cloaca	neg.	n.d.	n.d.	N/A
536C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8570 Ottenberg	TG	Choana	neg.	n.d.	n.d.	N/A
536K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8570 Ottenberg	TG	Cloaca	neg.	n.d.	n.d.	N/A
537C	Common buzzard	*Buteo buteo*	Adult	8610 Uster	ZH	Choana	neg.	n.d.	n.d.	N/A
537K	Common buzzard	*Buteo buteo*	Adult	8610 Uster	ZH	Cloaca	neg.	n.d.	n.d.	N/A
538C	Common buzzard	*Buteo buteo*	Adult	8156 Oberhasli	ZH	Choana	neg.	n.d.	n.d.	N/A
538K	Common buzzard	*Buteo buteo*	Adult	8156 Oberhasli	ZH	Cloaca	neg.	n.d.	n.d.	N/A
539C	Common buzzard	*Buteo buteo*	Adult	8253 Diessenhofen	TG	Choana	neg.	n.d.	n.d.	N/A
539K	Common buzzard	*Buteo buteo*	Adult	8253 Diessenhofen	TG	Cloaca	neg.	n.d.	n.d.	N/A
540C	Common buzzard	*Buteo buteo*	Adult	8225 Siblingen	SH	Choana	neg.	n.d.	n.d.	N/A
540K	Common buzzard	*Buteo buteo*	Adult	8225 Siblingen	SH	Cloaca	neg.	n.d.	n.d.	N/A
541C	Common buzzard	*Buteo buteo*	Adult	8400 Winterthur	ZH	Choana	neg.	n.d.	n.d.	N/A
541K	Common buzzard	*Buteo buteo*	Adult	8400 Winterthur	ZH	Cloaca	neg.	n.d.	n.d.	N/A
542C	Common buzzard	*Buteo buteo*	Adult	8226 Schleitheim	SH	Choana	neg.	n.d.	n.d.	N/A
542K	Common buzzard	*Buteo buteo*	Adult	8226 Schleitheim	SH	Cloaca	neg.	n.d.	n.d.	N/A
543C	Common buzzard	*Buteo buteo*	Adult	8185 Winkel	ZH	Choana	neg.	n.d.	n.d.	N/A
543K	Common buzzard	*Buteo buteo*	Adult	8185 Winkel	ZH	Cloaca	neg.	n.d.	n.d.	N/A
544C	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Choana	neg.	n.d.	n.d.	N/A
544K	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Cloaca	neg.	n.d.	n.d.	N/A
545C	Common buzzard	*Buteo buteo*	Adult	5634 Merenschwand	AG	Choana	neg.	n.d.	n.d.	N/A
545K	Common buzzard	*Buteo buteo*	Adult	5634 Merenschwand	AG	Cloaca	neg.	n.d.	n.d.	N/A

546C	Common buzzard	*Buteo buteo*		9000 St. Gallen	SG	Choana	neg.	n.d.	n.d.	N/A
546K	Common buzzard	*Buteo buteo*		9000 St. Gallen	SG	Cloaca	neg.	n.d.	n.d.	N/A
547C	Common buzzard	*Buteo buteo*		8247 Thayngen	SH	Choana	neg.	n.d.	n.d.	N/A
547K	Common buzzard	*Buteo buteo*		8247 Thayngen	SH	Cloaca	neg.	n.d.	n.d.	N/A
548K	Common buzzard	*Buteo buteo*		8926 Kappel am Albis	ZH	Cloaca	neg.	n.d.	n.d.	N/A
549C	Common buzzard	*Buteo buteo*	Adult	8902 Urdorf	ZH	Choana	neg.	n.d.	n.d.	N/A
549K	Common buzzard	*Buteo buteo*	Adult	8902 Urdorf	ZH	Cloaca	neg.	n.d.	n.d.	N/A
550C	Common buzzard	*Buteo buteo*	Adult	8136 Gattikon	ZH	Choana	neg.	n.d.	n.d.	N/A
550K	Common buzzard	*Buteo buteo*	Adult	8136 Gattikon	ZH	Cloaca	neg.	n.d.	n.d.	N/A
551C	Common buzzard	*Buteo buteo*	Adult	9506 Lommis	TG	Choana	neg.	n.d.	n.d.	N/A
551K	Common buzzard	*Buteo buteo*	Adult	9506 Lommis	TG	Cloaca	neg.	n.d.	n.d.	N/A
552C	Common buzzard	*Buteo buteo*		8265 Mammern	TG	Choana	neg.	n.d.	n.d.	N/A
552K	Common buzzard	*Buteo buteo*		8265 Mammern	TG	Cloaca	neg.	n.d.	n.d.	N/A
553C	Red kite	*Milvus milvus*		8108 Dällikon	ZH	Choana	neg.	n.d.	n.d.	N/A
553K	Red kite	*Milvus milvus*		8108 Dällikon	ZH	Cloaca	neg.	n.d.	n.d.	N/A
554C	Common buzzard	*Buteo buteo*	Adult	5313 Klingnau	AG	Choana	neg.	n.d.	n.d.	N/A
554K	Common buzzard	*Buteo buteo*	Adult	5313 Klingnau	AG	Cloaca	neg.	n.d.	n.d.	N/A
555C	Common buzzard	*Buteo buteo*	Adult	8280 Kreuzlingen	TG	Choana	neg.	n.d.	n.d.	N/A
555K	Common buzzard	*Buteo buteo*	Adult	8280 Kreuzlingen	TG	Cloaca	neg.	n.d.	n.d.	N/A
556C	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Choana	pos. (30.7)	neg.	neg.	*C. psittaci* M56
556K	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Cloaca	pos. (14.1)	neg.	neg.	*C. psittaci* M56
557C	Common buzzard	*Buteo buteo*	Adult	8305 Dietikon	ZH	Choana	pos. (37.1)	neg.	neg.	Not identified
557K	Common buzzard	*Buteo buteo*	Adult	8305 Dietikon	ZH	Cloaca	pos. (36.9)	neg.	neg.	Not identified
558C	Common buzzard	*Buteo buteo*	Adult	8320 Fehraltdorf	ZH	Choana	pos. (38.8)	neg.	neg.	Not identified
558K	Common buzzard	*Buteo buteo*	Adult	8320 Fehraltdorf	ZH	Cloaca	pos. (41.3)	neg.	neg.	Not identified
559C	Common buzzard	*Buteo buteo*	Adult	8165 Oberweningen	ZH	Choana	neg.	n.d.	n.d.	N/A

559K	Common buzzard	*Buteo buteo*	Adult	8165 Oberweningen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
560Kot	Common buzzard	*Buteo buteo*	Adult	6242 Wauwil	LU	Feces	neg.	n.d.	n.d.	N/A
561C	Common buzzard	*Buteo buteo*	Adult	6016 Hellbühl	LU	Choana	neg.	n.d.	n.d.	N/A
561K	Common buzzard	*Buteo buteo*	Adult	6016 Hellbühl	LU	Cloaca	neg.	n.d.	n.d.	N/A
562C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
562K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
562Kot	Common buzzard	*Buteo buteo*				Feces	neg.	n.d.	n.d.	N/A
563C	Common buzzard	*Buteo buteo*		8460 Marthalen	ZH	Choana	neg.	n.d.	n.d.	N/A
563K	Common buzzard	*Buteo buteo*		8460 Marthalen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
564Kot	Common buzzard	*Buteo buteo*	Adult	6014 Littau	LU	Feces	neg.	n.d.	n.d.	N/A
565C	Carrion crow	*Corvus corone*	Adult	4800 Zofingen	AG	Choana	pos. (27.9)	neg.	neg.	*C. psittaci* 1V
565K	Carrion crow	*Corvus corone*	Adult	4800 Zofingen	AG	Cloaca	neg.	n.d.	n.d.	N/A
565Kot	Carrion crow	*Corvus corone*	Adult	4800 Zofingen	AG	Feces	neg.	n.d.	n.d.	N/A
566C	Common buzzard	*Buteo buteo*	Adult	6055 Alpnach	OW	Choana	pos. (29.8)	neg.	neg.	*C. psittaci* 1V
566K	Common buzzard	*Buteo buteo*	Adult	6055 Alpnach	OW	Cloaca	neg.	n.d.	n.d.	N/A
567Kot	Long-eared owl	*Asio otus*		6042 Dietwil	AG	Feces	neg.	n.d.	n.d.	N/A
568C	Common buzzard	*Buteo buteo*	Adult	6122 Menznau	LU	Choana	neg.	n.d.	n.d.	N/A
568K	Common buzzard	*Buteo buteo*	Adult	6122 Menznau	LU	Cloaca	neg.	n.d.	n.d.	N/A
569C	Common buzzard	*Buteo buteo*	Adult	6211 Buchs	LU	Choana	neg.	n.d.	n.d.	N/A
569K	Common buzzard	*Buteo buteo*	Adult	6211 Buchs	LU	Cloaca	neg.	n.d.	n.d.	N/A
570C	Common buzzard	*Buteo buteo*	Adult	6253 Dagmersellen	LU	Choana	neg.	n.d.	n.d.	N/A
570K	Common buzzard	*Buteo buteo*	Adult	6253 Dagmersellen	LU	Cloaca	neg.	n.d.	n.d.	N/A
571C	Carrion crow	*Corvus corone*	Adult	6285 Hitzkirch	LU	Choana	neg.	n.d.	n.d.	N/A
571K	Carrion crow	*Corvus corone*	Adult	6285 Hitzkirch	LU	Cloaca	neg.	n.d.	n.d.	N/A
572C	Red kite	*Milvus milvus*	Adult	6207 Nottwil	LU	Choana	neg.	n.d.	n.d.	N/A
572K	Red kite	*Milvus milvus*	Adult	6207 Nottwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
573C	Eurasian magpie	*Pica pica*	Adult	6038 Gisikon	LU	Choana	neg.	n.d.	n.d.	N/A

573K	Eurasian magpie	*Pica pica*	Adult	6038 Gisikon	LU	Cloaca	neg.	n.d.	n.d.	N/A
574C	Common buzzard	*Buteo buteo*	Adult	6207 Nottwil	LU	Choana	neg.	n.d.	n.d.	N/A
574K	Common buzzard	*Buteo buteo*	Adult	6207 Nottwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
575K	Common buzzard	*Buteo buteo*	Adult	6233 Büron	LU	Cloaca	neg.	n.d.	n.d.	N/A
576C	Common buzzard	*Buteo buteo*	Adult	6287 Aesch	LU	Choana	neg.	n.d.	n.d.	N/A
576K	Common buzzard	*Buteo buteo*	Adult	6287 Aesch	LU	Cloaca	neg.	n.d.	n.d.	N/A
577C	Carrion crow	*Corvus corone*	Adult	Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
577K	Carrion crow	*Corvus corone*	Adult	Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
578C	Common kestrel	*Falco tinnunculus*	Adult	Reiden	LU	Choana	neg.	n.d.	n.d.	N/A
578K	Common kestrel	*Falco tinnunculus*	Adult	Reiden	LU	Cloaca	neg.	n.d.	n.d.	N/A
579Kot	Tawny owl	*Strix aluco*	Juvenile	6283 Baldegg	LU	Feces	neg.	n.d.	n.d.	N/A
580C	Red kite	*Milvus milvus*	Adult	6218 Ettiswil	LU	Choana	neg.	n.d.	n.d.	N/A
580K	Red kite	*Milvus milvus*	Adult	6218 Ettiswil	LU	Cloaca	neg.	n.d.	n.d.	N/A
581C	Rook	*Corvus frugilegus*	Juvenile	5712 Beinwil am See	AG	Choana	neg.	n.d.	n.d.	N/A
581K	Rook	*Corvus frugilegus*	Juvenile	5712 Beinwil am See	AG	Cloaca	neg.	n.d.	n.d.	N/A
581Kot	Rook	*Corvus frugilegus*	Juvenile	5712 Beinwil am See	AG	Feces	neg.	n.d.	n.d.	N/A
582Kot	Eurasian magpie	*Pica pica*	Juvenile	6275 Ballwil	LU	Feces	neg.	n.d.	n.d.	N/A
583Kot	Eurasian magpie	*Pica pica*	Juvenile	6275 Ballwil	LU	Feces	neg.	n.d.	n.d.	N/A
584Kot	Eurasian magpie	*Pica pica*	Juvenile	6276 Ballwil	LU	Feces	neg.	n.d.	n.d.	N/A
585Kot	Eurasian magpie	*Pica pica*	Juvenile	6275 Ballwil	LU	Feces	neg.	n.d.	n.d.	N/A
586Kot	Eurasian magpie	*Pica pica*	Juvenile	6278 Ballwil	LU	Feces	neg.	n.d.	n.d.	N/A
587C	Long-eared owl	*Asio otus*	Adult	6042 Dietwil	AG	Choana	neg.	n.d.	n.d.	N/A
587K	Long-eared owl	*Asio otus*	Adult	6042 Dietwil	AG	Cloaca	neg.	n.d.	n.d.	N/A
588Kot	Eurasian magpie	*Pica pica*	Adult	Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
589C	Common buzzard	*Buteo buteo*	Adult	5610 Wohlen	AG	Choana	neg.	n.d.	n.d.	N/A
589K	Common buzzard	*Buteo buteo*	Adult	5610 Wohlen	AG	Cloaca	neg.	n.d.	n.d.	N/A

590C	Red kite	*Milvus milvus*		6275 Ballwil	LU	Choana	neg.	n.d.	n.d.	N/A
590K	Red kite	*Milvus milvus*		6275 Ballwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
591Kot	Common buzzard	*Buteo buteo*	Adult	Zug	ZG	Feces	neg.	n.d.	n.d.	N/A
592C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	6210 Sursee	LU	Choana	neg.	n.d.	n.d.	N/A
592K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	6210 Sursee	LU	Cloaca	neg.	n.d.	n.d.	N/A
593Kot	Carrion crow	*Corvus corone*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
594C	Carrion crow	*Corvus corone*	Juvenile	6102 Malters	LU	Choana	neg.	n.d.	n.d.	N/A
594K	Carrion crow	*Corvus corone*	Juvenile	6102 Malters	LU	Cloaca	neg.	n.d.	n.d.	N/A
594Kot	Carrion crow	*Corvus corone*	Juvenile	6102 Malters	LU	Feces	neg.	n.d.	n.d.	N/A
595Kot	Tawny owl	*Strix aluco*	Juvenile	St. Gallen	SG	Feces	neg.	n.d.	n.d.	N/A
596Kot	Carrion crow	*Corvus corone*		6015 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
597Kot	Tawny owl	*Strix aluco*	Juvenile	4457 Diegten	BL	Feces	neg.	n.d.	n.d.	N/A
598Kot	Eurasian magpie	*Pica pica*	Juvenile	8805 Richterswil	ZH	Feces	neg.	n.d.	n.d.	N/A
599Kot	Eurasian magpie	*Pica pica*	Juvenile	6000 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
600C	Carrion crow	*Corvus corone*	Juvenile	5737 Menziken	AG	Choana	neg.	n.d.	n.d.	N/A
600K	Carrion crow	*Corvus corone*	Juvenile	5737 Menziken	AG	Cloaca	neg.	n.d.	n.d.	N/A
601K	Red kite	*Milvus milvus*	Adult	6207 Nottwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
602Kot	Carrion crow	*Corvus corone*	Juvenile	6102 Malters	LU	Feces	neg.	n.d.	n.d.	N/A
603C	Eurasian jay	*Garrulus glandarius*	Adult	8134 Adliswil	ZH	Choana	neg.	n.d.	n.d.	N/A
603K	Eurasian jay	*Garrulus glandarius*	Adult	8134 Adliswil	ZH	Cloaca	neg.	n.d.	n.d.	N/A
604C	Carrion crow	*Corvus corone*	Adult	Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
604K	Carrion crow	*Corvus corone*	Adult	Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
604Kot	Carrion crow	*Corvus corone*	Adult	Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
605C	Carrion crow	*Corvus corone*	Adult	6274 Eschenbach	SG	Choana	neg.	n.d.	n.d.	N/A
605K	Carrion crow	*Corvus corone*	Adult	6274 Eschenbach	SG	Cloaca	neg.	n.d.	n.d.	N/A
606Kot	Common buzzard	*Buteo buteo*		6027 Römerswil	LU	Feces	neg.	n.d.	n.d.	N/A
607Kot	Common buzzard	*Buteo buteo*	Adult	6027 Römerswil	LU	Feces	neg.	n.d.	n.d.	N/A
608Kot	Carrion crow	*Corvus corone*		6383 Dallenwil	NW	Feces	neg.	n.d.	n.d.	N/A

609Kot	Carrion crow	*Corvus corone*	Juvenile	6022 Grosswangen	LU	Feces	neg.	n.d.	n.d.	N/A
611C	Eurasian magpie	*Pica pica*	Adult	6017 Ruswil	LU	Choana	neg.	n.d.	n.d.	N/A
611K	Eurasian magpie	*Pica pica*	Adult	6017 Ruswil	LU	Cloaca	neg.	n.d.	n.d.	N/A
611Kot	Eurasian magpie	*Pica pica*	Adult	6017 Ruswil	LU	Feces	neg.	n.d.	n.d.	N/A
612C	Carrion crow	*Corvus corone*	Juvenile	6212 St. Erhard	LU	Choana	neg.	n.d.	n.d.	N/A
612K	Carrion crow	*Corvus corone*	Juvenile	6212 St. Erhard	LU	Cloaca	neg.	n.d.	n.d.	N/A
613Kot	Carrion crow	*Corvus corone*	Juvenile	6280 Urswil	LU	Feces	neg.	n.d.	n.d.	N/A
614C	Carrion crow	*Corvus corone*		6242 Wauwil	LU	Choana	neg.	n.d.	n.d.	N/A
614K	Carrion crow	*Corvus corone*		6242 Wauwil	LU	Cloaca	neg.	n.d.	n.d.	N/A
615C	Common buzzard	*Buteo buteo*		6103 Schwarzenberg	LU	Choana	neg.	n.d.	n.d.	N/A
615K	Common buzzard	*Buteo buteo*		6103 Schwarzenberg	LU	Cloaca	neg.	n.d.	n.d.	N/A
616Kot	Red kite	*Milvus milvus*	Adult	5628 Aristau	AG	Feces	neg.	n.d.	n.d.	N/A
617C	Eurasian magpie	*Pica pica*	Juvenile	6015 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
617K	Eurasian magpie	*Pica pica*	Juvenile	6015 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
617Kot	Eurasian magpie	*Pica pica*	Juvenile	6015 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
618C	Carrion crow	*Corvus corone*	Juvenile	6287 Aesch	LU	Choana	neg.	n.d.	n.d.	N/A
618K	Carrion crow	*Corvus corone*	Juvenile	6287 Aesch	LU	Cloaca	neg.	n.d.	n.d.	N/A
619C	Carrion crow	*Corvus corone*	Juvenile	4312 Magden	AG	Choana	neg.	n.d.	n.d.	N/A
619K	Carrion crow	*Corvus corone*	Juvenile	4312 Magden	AG	Cloaca	neg.	n.d.	n.d.	N/A
620Kot	Common kestrel	*Falco tinnunculus*	Adult	6373 Ennetbürgen	NW	Feces	neg.	n.d.	n.d.	N/A
621C	Rook	*Corvus frugilegus*	Juvenile			Choana	pos. (23.9)	neg.	neg.	*C. psittaci* 1V
621K	Rook	*Corvus frugilegus*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
621Kot	Rook	*Corvus frugilegus*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
622C	Eurasian magpie	*Pica pica*	Adult	6102 Malters	LU	Choana	neg.	n.d.	n.d.	N/A
622K	Eurasian magpie	*Pica pica*	Adult	6102 Malters	LU	Cloaca	neg.	n.d.	n.d.	N/A
622Kot	Eurasian magpie	*Pica pica*	Adult	6102 Malters	LU	Feces	neg.	n.d.	n.d.	N/A

623C	Eurasian magpie	*Pica pica*	Juvenile	5634 Merenschwand	AG	Choana	neg.	n.d.	n.d.	N/A
623K	Eurasian magpie	*Pica pica*	Juvenile	5634 Merenschwand	AG	Cloaca	neg.	n.d.	n.d.	N/A
623Kot	Eurasian magpie	*Pica pica*	Juvenile	5634 Merenschwand	AG	Feces	neg.	n.d.	n.d.	N/A
624Kot	Common kestrel	*Falco tinnunculus*	Adult	6014 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
625C	Black kite	*Milvus migrans*	Adult	6289 Hämikon	LU	Choana	neg.	n.d.	n.d.	N/A
625K	Black kite	*Milvus migrans*	Adult	6289 Hämikon	LU	Cloaca	neg.	n.d.	n.d.	N/A
626C	Eurasian magpie	*Pica pica*	Juvenile	6203 Sempach-Station	LU	Choana	neg.	n.d.	n.d.	N/A
626K	Eurasian magpie	*Pica pica*	Juvenile	6203 Sempach-Station	LU	Cloaca	neg.	n.d.	n.d.	N/A
626Kot	Eurasian magpie	*Pica pica*	Juvenile	6203 Sempach-Station	LU	Feces	neg.	n.d.	n.d.	N/A
627Kot	Carrion crow	*Corvus corone*	Juvenile	6020 Emmenbrücke	LU	Feces	neg.	n.d.	n.d.	N/A
628Kot	Western jackdaw		Juvenile	6000 Luzern	LU	Feces	neg.	n.d.	n.d.	N/A
629C	Carrion crow	*Corvus corone*	Juvenile	5628 Aristau	AG	Choana	neg.	n.d.	n.d.	N/A
629K	Carrion crow	*Corvus corone*	Juvenile	5628 Aristau	AG	Cloaca	neg.	n.d.	n.d.	N/A
630C	Carrion crow	*Corvus corone*	Juvenile	6005 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
630K	Carrion crow	*Corvus corone*	Juvenile	6005 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
631C	Western jackdaw	*Corvus monedula*	Juvenile	4915 St. Urban	LU	Choana	neg.	n.d.	n.d.	N/A
631K	Western jackdaw	*Corvus monedula*	Juvenile	4915 St. Urban	LU	Cloaca	neg.	n.d.	n.d.	N/A
631Kot	Western jackdaw	*Corvus monedula*	Juvenile	4915 St. Urban	LU	Feces	neg.	n.d.	n.d.	N/A
632Kot	Western jackdaw	*Corvus monedula*	Juvenile			Feces	neg.	n.d.	n.d.	N/A
633C	Carrion crow	*Corvus corone*	Juvenile	6006 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
633K	Carrion crow	*Corvus corone*	Juvenile	6006 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
635C	Carrion crow	*Corvus corone*	Juvenile	5037 Muhen	AG	Choana	neg.	n.d.	n.d.	N/A
635K	Carrion crow	*Corvus corone*	Juvenile	5037 Muhen	AG	Cloaca	neg.	n.d.	n.d.	N/A
636C	Barn owl	*Tyto alba*	Adult	6203 Sempach-Station	LU	Choana	neg.	n.d.	n.d.	N/A

636K	Barn owl	*Tyto alba*	Adult	6203 Sempach-Station	LU	Cloaca	neg.	n.d.	n.d.	N/A
636Kot	Barn owl	*Tyto alba*	Adult	6203 Sempach-Station	LU	Feces	neg.	n.d.	n.d.	N/A
637C	Carrion crow	*Corvus corone*	Juvenile	6000 Luzern	LU	Choana	neg.	n.d.	n.d.	N/A
637K	Carrion crow	*Corvus corone*	Juvenile	6000 Luzern	LU	Cloaca	neg.	n.d.	n.d.	N/A
655C	Common buzzard	*Buteo buteo*		8213 Neunkirch	SH	Choana	neg.	n.d.	n.d.	N/A
655K	Common buzzard	*Buteo buteo*		8213 Neunkirch	SH	Cloaca	neg.	n.d.	n.d.	N/A
656C	Eurasian sparrowhawk	*Accipiter nisus*		8625 Gossau	SG	Choana	neg.	n.d.	n.d.	N/A
656K	Eurasian sparrowhawk	*Accipiter nisus*		8625 Gossau	SG	Cloaca	neg.	n.d.	n.d.	N/A
657C	Common buzzard	*Buteo buteo*		9548 Matzingen	TG	Choana	neg.	n.d.	n.d.	N/A
657K	Common buzzard	*Buteo buteo*		9548 Matzingen	TG	Cloaca	neg.	n.d.	n.d.	N/A
658C	Common buzzard	*Buteo buteo*		8302 Kloten	ZH	Choana	neg.	n.d.	n.d.	N/A
658K	Common buzzard	*Buteo buteo*		8302 Kloten	ZH	Cloaca	neg.	n.d.	n.d.	N/A
659C	Red kite	*Milvus milvus*		8547 Kefikon	TG	Choana	neg.	n.d.	n.d.	N/A
659K	Red kite	*Milvus milvus*		8547 Kefikon	TG	Cloaca	neg.	n.d.	n.d.	N/A
660C	Common buzzard	*Buteo buteo*		8590 Romanshorn	TG	Choana	neg.	n.d.	n.d.	N/A
660K	Common buzzard	*Buteo buteo*		8590 Romanshorn	TG	Cloaca	neg.	n.d.	n.d.	N/A
661C	Common kestrel	*Falco tinnunculus*		3267 Seedorf	BE	Choana	neg.	n.d.	n.d.	N/A
661K	Common kestrel	*Falco tinnunculus*		3267 Seedorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
662C	Common kestrel	*Falco tinnunculus*		3125 Toffen	BE	Choana	neg.	n.d.	n.d.	N/A
662K	Common kestrel	*Falco tinnunculus*		3125 Toffen	BE	Cloaca	neg.	n.d.	n.d.	N/A
663C	Common buzzard	*Buteo buteo*		4553 Subingen	SO	Choana	neg.	n.d.	n.d.	N/A
663K	Common buzzard	*Buteo buteo*		4553 Subingen	SO	Cloaca	neg.	n.d.	n.d.	N/A
664C	Eurasian magpie	*Pica pica*		3280 Murten	FR	Choana	neg.	n.d.	n.d.	N/A
664K	Eurasian magpie	*Pica pica*		3280 Murten	FR	Cloaca	neg.	n.d.	n.d.	N/A
665C	Common buzzard	*Buteo buteo*		3628 Uttigen	BE	Choana	neg.	n.d.	n.d.	N/A
665K	Common buzzard	*Buteo buteo*		3628 Uttigen	BE	Cloaca	neg.	n.d.	n.d.	N/A

666Kot	Common buzzard	*Buteo buteo*		3380 Wangen a.d. Aare	BE	Feces	neg.	n.d.	n.d.	N/A
667C	Red kite	*Milvus milvus*		8454 Buchberg	SH	Choana	neg.	n.d.	n.d.	N/A
667K	Red kite	*Milvus milvus*		8454 Buchberg	SH	Cloaca	neg.	n.d.	n.d.	N/A
668C	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Choana	pos. (38.3)	neg.	neg.	Not identified
668K	Common buzzard	*Buteo buteo*	Adult	8416 Flaach	ZH	Cloaca	neg.	n.d.	n.d.	N/A
669C	Common buzzard	*Buteo buteo*	Adult			Choana	pos. (27.9)	neg.	neg.	*C. psittaci* M56
669K	Common buzzard	*Buteo buteo*	Adult			Cloaca	pos. (16.2)	neg.	neg.	*C. psittaci* M56
670C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
670K	Common buzzard	*Buteo buteo*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
671C	Common buzzard	*Buteo buteo*	Adult	8254 Basadingen	TG	Choana	pos. (34.0)	neg.	neg.	*C. psittaci* M56
671K	Common buzzard	*Buteo buteo*	Adult	8254 Basadingen	TG	Cloaca	pos. (27.1)	neg.	neg.	*C. psittaci* M56
672C	Common buzzard	*Buteo buteo*	Adult	8315 Tagelswangen	ZH	Choana	pos. (37.1)	neg.	neg.	Not identified
672K	Common buzzard	*Buteo buteo*	Adult	8315 Tagelswangen	ZH	Cloaca	pos. (37.5)	neg.	neg.	Not identified
673C	Common buzzard	*Buteo buteo*	Adult	8200 Schaffhausen	SH	Choana	pos. (35.8)	neg.	neg.	Not identified
673K	Common buzzard	*Buteo buteo*	Adult	8200 Schaffhausen	SH	Cloaca	pos. (35.9)	neg.	neg.	Not identified
674C	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Choana	pos. (36.9)	neg.	neg.	Not identified
674K	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Cloaca	pos. (36.67)	neg.	neg.	Not identified
675C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8472 Seuzach	ZH	Choana	neg.	n.d.	n.d.	N/A
675K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8472 Seuzach	ZH	Cloaca	pos. (36.62)	neg.	neg.	Not identified
676C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8192 Glattfelden	ZH	Choana	neg.	n.d.	n.d.	N/A
676K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	8192 Glattfelden	ZH	Cloaca	neg.	n.d.	n.d.	N/A
677C	Red kite	*Milvus milvus*	Adult	8952 Schlieren	ZH	Choana	neg.	n.d.	n.d.	N/A
677K	Red kite	*Milvus milvus*	Adult	8952 Schlieren	ZH	Cloaca	pos. (33.5)	neg.	neg.	Not identified
679C	Common buzzard	*Buteo buteo*		9113 Degersheim	SG	Choana	neg.	n.d.	n.d.	N/A
679K	Common buzzard	*Buteo buteo*		9113 Degersheim	SG	Cloaca	neg.	n.d.	n.d.	N/A
680C	Common buzzard	*Buteo buteo*		5620 Bremgarten	AG	Choana	neg.	n.d.	n.d.	N/A
680K	Common buzzard	*Buteo buteo*		5620 Bremgarten	AG	Cloaca	neg.	n.d.	n.d.	N/A

681C	Common buzzard	*Buteo buteo*	Adult	8232 Merishausen	SH	Choana	neg.	n.d.	n.d.	N/A
681K	Common buzzard	*Buteo buteo*	Adult	8232 Merishausen	SH	Cloaca	neg.	n.d.	n.d.	N/A
682C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
682K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
683C	Common buzzard	*Buteo buteo*				Choana	pos. (33.3)	pos. (33.2)	neg.	*C. psittaci* A
683K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
684C	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
684K	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
685C	Carrion crow	*Corvus corone*	Juvenile	Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
685K	Carrion crow	*Corvus corone*	Juvenile	Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
686C	Carrion crow	*Corvus corone*	Juvenile	8003 Zürich	ZH	Choana	pos. (34.5)	neg.	neg.	*C. abortus*/*C. psittaci*
686K	Carrion crow	*Corvus corone*	Juvenile	8003 Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
687C	Common buzzard	*Buteo buteo*		8465 Trüllikon	ZH	Choana	neg.	n.d.	n.d.	N/A
687K	Common buzzard	*Buteo buteo*		8465 Trüllikon	ZH	Cloaca	neg.	n.d.	n.d.	N/A
688C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (28.2)	neg.	neg.	*C. psittaci* 1V
688K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	pos. (33.8)	neg.	neg.	*C. abortus*/*C. psittaci*
689C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (26.8)	neg.	neg.	*C. psittaci* 1V
689K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	pos. (33.2)	neg.	neg.	*C. abortus*/*C. psittaci*
690C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (29.4)	neg.	neg.	*C. psittaci* 1V
690K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
691C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
691K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
692C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
692K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
693C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
693K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
694C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
694K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A

695C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
695K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
696C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (28.9)	neg.	neg.	*C. abortus*/*C. psittaci*
696K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	pos. (36.9 (1:10))	neg.	neg.	Not identified
697C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
697K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
698C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
698K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
699C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
699K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
700C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	neg.	neg.	N/A
700K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
701C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
701K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
702C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (31.6)	neg.	neg.	*C. abortus*/*C. psittaci*
702K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
703C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
703K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
704C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
704K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
705C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (30.9)	neg.	neg.	*C. abortus*/*C. psittaci*
705K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	pos. (37.2)	neg.	neg.	Not identified
706C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (30.2)	neg.	neg.	*C. psittaci* D
706K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
707C	Eurasian magpie	*Pica pica*	Juvenile			Choana	neg.	n.d.	n.d.	N/A
707K	Eurasian magpie	*Pica pica*	Juvenile			Cloaca	neg.	n.d.	n.d.	N/A
708C	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A

708K	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
711C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	pos. (31.6)	neg.	neg.	*C. psittaci* 1V
711K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
712C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
712K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
713C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
713K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
714C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
714K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
715C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	pos. (38.1)	neg.	neg.	Not identified
715K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
716C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
716K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	pos. (30.6)	neg.	neg.	*C. psittaci* D
717C	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
717K	Carrion crow	*Corvus corone*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
718C	Rook	*Corvus frugilegus*	Adult	2564 Bellmund	BE	Choana	neg.	n.d.	n.d.	N/A
718K	Rook	*Corvus frugilegus*	Adult	2564 Bellmund	BE	Cloaca	neg.	n.d.	n.d.	N/A
719C	Common buzzard	*Buteo buteo*		3270 Aarberg	BE	Choana	neg.	n.d.	n.d.	N/A
719K	Common buzzard	*Buteo buteo*		3270 Aarberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
720C	Eurasian hobby	*Falco subbuteo*		8452 Adlikon	ZH	Choana	neg.	n.d.	n.d.	N/A
720K	Eurasian hobby	*Falco subbuteo*		8452 Adlikon	ZH	Cloaca	neg.	n.d.	n.d.	N/A
721C	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Choana	pos. (29.9)	neg.	neg.	*C. psittaci* 1V
721K	Carrion crow	*Corvus corone*	Adult	Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
722C	Carrion crow	*Corvus corone*	Juvenile	Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
722K	Carrion crow	*Corvus corone*	Juvenile	Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
723C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A
723K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
724C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	neg.	n.d.	n.d.	N/A

724K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
725C	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Choana	pos. (31.6)	neg.	neg.	*C. abortus*/*C. psittaci*
725K	Carrion crow	*Corvus corone*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
726K	Common kestrel	*Falco tinnunculus*		Stadt Zürich	ZH	Cloaca	neg.	n.d.	n.d.	N/A
727C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
727K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
728C	Barn owl	*Tyto alba*		1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
728K	Barn owl	*Tyto alba*		1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
729C	Tawny owl	*Strix aluco*		1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
729K	Tawny owl	*Strix aluco*		1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
730C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
730K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
731C	Red kite	*Milvus milvus*				Choana	neg.	n.d.	n.d.	N/A
731K	Red kite	*Milvus milvus*				Cloaca	neg.	n.d.	n.d.	N/A
732C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
732K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
733C	Eurasian sparrowhawk	*Accipiter nisus*				Choana	neg.	n.d.	n.d.	N/A
733K	Eurasian sparrowhawk	*Accipiter nisus*				Cloaca	neg.	n.d.	n.d.	N/A
734C	Long-eared owl	*Asio otus*				Choana	neg.	n.d.	n.d.	N/A
734K	Long-eared owl	*Asio otus*				Cloaca	neg.	n.d.	n.d.	N/A
735C	Carrion crow	*Corvus corone*		Zug	ZG	Choana	pos. (28.4)	neg.	neg.	*C. psittaci* 1V
735K	Carrion crow	*Corvus corone*		Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
736C	Carrion crow	*Corvus corone*		Zug	ZG	Choana	pos. (28.7)	neg.	neg.	*C. psittaci* 6N
736K	Carrion crow	*Corvus corone*		Zug	ZG	Cloaca	pos. (30.6)	neg.	neg.	*C. abortus*/*C. psittaci*
737C	Carrion crow	*Corvus corone*		Zug	ZG	Choana	pos. (31.1)	neg.	neg.	*C. abortus*/*C. psittaci*
737K	Carrion crow	*Corvus corone*		Zug	ZG	Cloaca	pos. (32.7)	neg.	neg.	*C. abortus*/*C. psittaci*
738C	Carrion crow	*Corvus corone*		Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
738K	Carrion crow	*Corvus corone*		Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A

739C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
739K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
740C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (27.7)	neg.	neg.	*C. psittaci* 1V
740K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (28.0)	neg.	neg.	*C. abortus*/*C. psittaci*
741C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
741K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
742C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
742K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
743C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
743K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
744C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos.(33.6)	neg.	neg.	*C. abortus*/*C. psittaci*
744K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
745C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
745K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
746C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (24.9)	neg.	neg.	*C. psittaci* 1V
746K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (39.6)	neg.	neg.	Not identified
747C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
747K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
748C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
748K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
749C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (39.6)	neg.	neg.	Not identified
749K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
750C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (31.5)	neg.	neg.	*C. abortus*/*C. psittaci*
750K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (31.5)	neg.	neg.	*C. abortus*/*C. psittaci*
751C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (20.2)	neg.	neg.	*C. psittaci* 1V
751K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (27.7)	neg.	neg.	*C. abortus*/*C. psittaci*
752C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (30.4)	neg.	neg.	*C. psittaci* 1V
752K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (33.0)	neg.	neg.	*C. abortus*/*C. psittaci*

753C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (34.0)	neg.	neg.	*C. abortus*/*C. psittaci*
753K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
754C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (26.3)	neg.	neg.	*C. abortus*/*C. psittaci*
754K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (29.3)	neg.	neg.	Not identified
755C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (36.7)	neg.	neg.	Not identified
755K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (37.5)	neg.	neg.	Not identified
756C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (34.0)	neg.	neg.	*C. abortus*/*C. psittaci*
756K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (32.9)	neg.	neg.	*C. abortus*/*C. psittaci*
757C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (37.28)	neg.	neg.	Not identified
757K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
758C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
758K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (39.7)	neg.	neg.	Not identified
759C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (33.1)	neg.	neg.	*C. abortus*/*C. psittaci*
759K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
760C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (25.9)	neg.	neg.	*C. abortus*/*C. psittaci*
760K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (31.9)	neg.	neg.	*C. abortus*/*C. psittaci*
761C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (29.7)	neg.	neg.	*C. psittaci* 1V
761K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	neg.	neg.	N/A
762C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (35.8)	neg.	neg.	Not identified
762K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
763C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
763K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
764C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (33.9)	neg.	neg.	*C. abortus*/*C. psittaci*
764K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
765C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (33.6)	neg.	neg.	*C. abortus*/*C. psittaci*
765K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
766C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
766K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A

767C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
767K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
768C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
768K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
769C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (24.6)	neg.	neg.	*C. abortus*/*C. psittaci*
769K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
770C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (31.2)	neg.	neg.	*C. abortus*/*C. psittaci*
770K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
771C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
771K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
772C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (29.9)	neg.	neg.	*C. abortus*/*C. psittaci*
772K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (26.8)	neg.	neg.	*C. psittaci* 1V
773C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (31.0)	neg.	neg.	*C. abortus*/*C. psittaci*
773K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	pos. (37.4 (1:10))	neg.	neg.	Not identified
774C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	pos. (31.9)	neg.	neg.	*C. abortus*/*C. psittaci*
774K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
775C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
775K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
776C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
776K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
777C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
777K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
778C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
778K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
779C	Carrion crow	*Corvus corone*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
779K	Carrion crow	*Corvus corone*	Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
780C	Common buzzard	*Buteo buteo*	Zug	ZG	Choana	neg.	n.d.	n.d.	N/A

780K	Common buzzard	*Buteo buteo*		Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
781C	Common buzzard	*Buteo buteo*		Zug	ZG	Choana	neg.	neg.	neg.	N/A
782C	Common buzzard	*Buteo buteo*		Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
782K	Common buzzard	*Buteo buteo*		Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
783C	Common buzzard	*Buteo buteo*		Zug	ZG	Choana	neg.	n.d.	n.d.	N/A
783K	Common buzzard	*Buteo buteo*		Zug	ZG	Cloaca	neg.	n.d.	n.d.	N/A
784C	Common kestrel	*Falco tinnunculus*		8610 Uster	ZH	Choana	neg.	n.d.	n.d.	N/A
784K	Common kestrel	*Falco tinnunculus*		8610 Uster	ZH	Cloaca	neg.	n.d.	n.d.	N/A
785C	Red kite	*Milvus milvus*		Schaffhausen	SH	Choana	neg.	n.d.	n.d.	N/A
785K	Red kite	*Milvus milvus*		Schaffhausen	SH	Cloaca	neg.	n.d.	n.d.	N/A
796C	Long-eared owl	*Asio otus*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
796K	Long-eared owl	*Asio otus*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
797C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (33.5)	neg.	neg.	*C. abortus*/*C. psittaci*
797K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (33.6)	neg.	neg.	*C. abortus*/*C. psittaci*
798C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (28.2)	neg.	neg.	*C. abortus*/*C. psittaci*
798K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (26.7)	neg.	neg.	*C. psittaci* 1V
799C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
799K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
800C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
800K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
801C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
801K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
802C	Long-eared owl	*Asio otus*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
802K	Long-eared owl	*Asio otus*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
803C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
803K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
804C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
804K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A

805C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
805K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
806C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
806K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
807C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
807K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
808C	Eurasian magpie	*Pica pica*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
808K	Eurasian magpie	*Pica pica*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
809C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
809K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
810C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
810K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
811C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
811K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
812C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
812K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
813C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
813K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
814C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (25.6)	neg.	neg.	*C. psittaci* 1V
814K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (29.1)	neg.	neg.	*C. abortus*/*C. psittaci*
815C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
815K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
816Kot	Common kestrel	*Falco tinnunculus*		3256 Bangerten	BE	Feces	neg.	n.d.	n.d.	N/A
817Kot	Tawny owl	*Strix aluco*		3253 Schnottwil	SO	Feces	neg.	n.d.	n.d.	N/A
818C	Long-eared owl	*Asio otus*		3427 Utzenstorf	BE	Choana	neg.	n.d.	n.d.	N/A
818K	Long-eared owl	*Asio otus*		3427 Utzenstorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
819C	Carrion crow	*Corvus corone*		3432 Lützelflüh	BE	Choana	neg.	n.d.	n.d.	N/A
819K	Carrion crow	*Corvus corone*		3432 Lützelflüh	BE	Cloaca	neg.	n.d.	n.d.	N/A

820C	Eurasian hobby	*Falco subbuteo*		4573 Lohn-Ammansegg	SO	Choana	neg.	n.d.	n.d.	N/A
820K	Eurasian hobby	*Falco subbuteo*		4573 Lohn-Ammansegg	SO	Cloaca	neg.	n.d.	n.d.	N/A
821C	Black kite	*Milvus migrans*		3603 Uetendorf	BE	Choana	neg.	n.d.	n.d.	N/A
821K	Black kite	*Milvus migrans*		3603 Uetendorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
824C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
824K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
825C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
825K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
826C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (29.3)	neg.	neg.	*C. psittaci* 1V
826K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
827C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
827K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
828C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
828K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
829C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
829K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
830C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
830K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
831C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
831K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
832C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
832K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
833C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
833K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
834C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
834K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
835C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A

835K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
836C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
836K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
837C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
837K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
838C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
838K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
839C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
839K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
840C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
840K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
841C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
841K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
842C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (37.1)	neg.	neg.	Not identified
842K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
843C	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
843K	Carrion crow	*Corvus corone*	Juvenile	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
844C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
844K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
845C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
845K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
846C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (31.8)	neg.	neg.	*C. abortus*/*C. psittaci*
846K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (37.7)	neg.	neg.	Not identified
847C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (33.0)	neg.	neg.	*C. abortus*/*C. psittaci*
847K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
848C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (26.6)	neg.	neg.	*C. psittaci* D
848K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
849C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (39.1)	neg.	neg.	Not identified

849K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (38.4)	neg.	neg.	Not identified
850C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (28.5)	neg.	neg.	*C. abortus*/*C. psittaci*
850K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (27.9)	neg.	neg.	*C. psittaci* 1V
851C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (31.9)	neg.	neg.	*C. abortus*/*C. psittaci*
851K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
852C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
852K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
853C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (34.6)	neg.	neg.	Not identified
853K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
854C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
854K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
855C	Eurasian sparrowhawk	*Accipiter nisus*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
855K	Eurasian sparrowhawk	*Accipiter nisus*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
856C	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Choana	pos. (29.3)	neg.	neg.	*C. psittaci* 1V
856K	Carrion crow	*Corvus corone*		Zürich Flughafen	ZH	Cloaca	pos. (42.5)	neg.	neg.	Not identified
857C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (39.6)	neg.	neg.	Not identified
857K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (33.9)	neg.	neg.	Not identified
858C	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Choana	pos. (27.8)	neg.	neg.	*C. psittaci* 1V
858K	Carrion crow	*Corvus corone*	Adult	Zürich Flughafen	ZH	Cloaca	pos. (32.3)	neg.	neg.	*C. abortus*/*C. psittaci*
859C	Common kestrel	*Falco tinnunculus*		Zürich Flughafen	ZH	Choana	neg.	n.d.	n.d.	N/A
859K	Common kestrel	*Falco tinnunculus*		Zürich Flughafen	ZH	Cloaca	neg.	n.d.	n.d.	N/A
860C	Long-eared owl	*Asio otus*	Adult	6042 Dietwil	AG	Choana	neg.	n.d.	n.d.	N/A
860K	Long-eared owl	*Asio otus*	Adult	6042 Dietwil	AG	Cloaca	neg.	n.d.	n.d.	N/A
861C	Carrion crow	*Corvus corone*	Adult			Choana	pos. (22.4)	neg.	neg.	*C. abortus*/*C. psittaci*
861K	Carrion crow	*Corvus corone*	Adult			Cloaca	pos. (23.6)	neg.	neg.	*C. psittaci* 1V
862C	Eurasian jay	*Garrulus glandarius*				Choana	neg.	n.d.	n.d.	N/A
862K	Eurasian jay	*Garrulus glandarius*				Cloaca	neg.	n.d.	n.d.	N/A
863C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A

863K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
864C	Common buzzard	*Buteo buteo*	Adult	3474 Wynigen	BE	Choana	neg.	n.d.	n.d.	N/A
864K	Common buzzard	*Buteo buteo*	Adult	3474 Wynigen	BE	Cloaca	neg.	n.d.	n.d.	N/A
865C	Long-eared owl	*Asio otus*	Juvenile	6026 Rain	LU	Choana	neg.	n.d.	n.d.	N/A
866C	Carrion crow	*Corvus corone*	Juvenile	6023 Rothenburg	LU	Choana	neg.	n.d.	n.d.	N/A
867C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
867K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
868C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
868K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
869C	Common kestrel	*Falco tinnunculus*				Choana	neg.	n.d.	n.d.	N/A
869K	Common kestrel	*Falco tinnunculus*				Cloaca	neg.	n.d.	n.d.	N/A
870C	Common kestrel	*Falco tinnunculus*				Choana	neg.	n.d.	n.d.	N/A
870K	Common kestrel	*Falco tinnunculus*				Cloaca	neg.	n.d.	n.d.	N/A
871C	Common kestrel	*Falco tinnunculus*	Adult	3267 Seedorf	BE	Choana	neg.	n.d.	n.d.	N/A
871K	Common kestrel	*Falco tinnunculus*	Adult	3267 Seedorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
872C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	2542 Pieterlen	BE	Choana	neg.	n.d.	n.d.	N/A
872K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	2542 Pieterlen	BE	Cloaca	neg.	n.d.	n.d.	N/A
873C	Common kestrel	*Falco tinnunculus*				Choana	neg.	n.d.	n.d.	N/A
873K	Common kestrel	*Falco tinnunculus*				Cloaca	neg.	n.d.	n.d.	N/A
874C	Tawny owl	*Strix aluco*				Choana	neg.	n.d.	n.d.	N/A
874K	Tawny owl	*Strix aluco*				Cloaca	neg.	n.d.	n.d.	N/A
875C	Eurasian sparrowhawk	*Accipiter nisus*				Choana	neg.	n.d.	n.d.	N/A
875K	Eurasian sparrowhawk	*Accipiter nisus*				Cloaca	neg.	n.d.	n.d.	N/A
876C	Tawny owl	*Strix aluco*		3412 Heimiswil	BE	Choana	neg.	n.d.	n.d.	N/A
876K	Tawny owl	*Strix aluco*		3412 Heimiswil	BE	Cloaca	neg.	n.d.	n.d.	N/A
877C	Long-eared owl	*Asio otus*	Juvenile	3360 Herzogenbuchsee	BE	Choana	pos. (34.0)	neg.	neg.	Not identified
877K	Long-eared owl	*Asio otus*	Juvenile	3360 Herzogenbuchsee	BE	Cloaca	pos. (31.3)	neg.	neg.	*C. psittaci* M56

878C	Common buzzard	*Buteo buteo*		3315 Bätterkinden	BE	Choana	neg.	n.d.	n.d.	N/A
878K	Common buzzard	*Buteo buteo*		3315 Bätterkinden	BE	Cloaca	neg.	n.d.	n.d.	N/A
879C	Common buzzard	*Buteo buteo*	Adult	4614 Hägendorf	SO	Choana	neg.	n.d.	n.d.	N/A
879K	Common buzzard	*Buteo buteo*	Adult	4614 Hägendorf	SO	Cloaca	neg.	n.d.	n.d.	N/A
880C	Common buzzard	*Buteo buteo*	Adult	3628 Uttigen	BE	Choana	neg.	n.d.	n.d.	N/A
880K	Common buzzard	*Buteo buteo*	Adult	3628 Uttigen	BE	Cloaca	neg.	n.d.	n.d.	N/A
881C	Common buzzard	*Buteo buteo*	Adult	3380 Wangen a.d. Aare	BE	Choana	neg.	n.d.	n.d.	N/A
881K	Common buzzard	*Buteo buteo*	Adult	3380 Wangen a.d. Aare	BE	Cloaca	neg.	n.d.	n.d.	N/A
882C	Carrion crow	*Corvus corone*	Juvenile	3007 Bern	BE	Choana	neg.	n.d.	n.d.	N/A
882K	Carrion crow	*Corvus corone*	Juvenile	3007 Bern	BE	Cloaca	neg.	n.d.	n.d.	N/A
883C	Carrion crow	*Corvus corone*	Juvenile	3366 Bollodingen	BE	Choana	neg.	n.d.	n.d.	N/A
883K	Carrion crow	*Corvus corone*	Juvenile	3366 Bollodingen	BE	Cloaca	neg.	n.d.	n.d.	N/A
884C	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Choana	neg.	n.d.	n.d.	N/A
884K	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
885C	Common kestrel	*Falco tinnunculus*	Adult	3317 Mülchi	BE	Choana	neg.	n.d.	n.d.	N/A
885K	Common kestrel	*Falco tinnunculus*	Adult	3317 Mülchi	BE	Cloaca	neg.	n.d.	n.d.	N/A
886C	Barn owl	*Tyto alba*	Adult	4586 Kyburg-Buchegg	SO	Choana	neg.	n.d.	n.d.	N/A
886K	Barn owl	*Tyto alba*	Adult	4586 Kyburg-Buchegg	SO	Cloaca	neg.	n.d.	n.d.	N/A
887C	Common kestrel	*Falco tinnunculus*	Adult	4554 Etziken	SO	Choana	neg.	n.d.	n.d.	N/A
887K	Common kestrel	*Falco tinnunculus*	Adult	4554 Etziken	SO	Cloaca	neg.	n.d.	n.d.	N/A
888C	Common kestrel	*Falco tinnunculus*	Adult	4710 Balsthal	SO	Choana	neg.	n.d.	n.d.	N/A
888K	Common kestrel	*Falco tinnunculus*	Adult	4710 Balsthal	SO	Cloaca	neg.	n.d.	n.d.	N/A
889C	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Choana	neg.	n.d.	n.d.	N/A
889K	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
890C	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Choana	neg.	n.d.	n.d.	N/A
890K	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A

891C	Barn owl	*Tyto alba*	Adult	3365 Seeberg	BE	Choana	neg.	n.d.	n.d.	N/A
891K	Barn owl	*Tyto alba*	Adult	3365 Seeberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
892C	Long-eared owl	*Asio otus*	Adult			Choana	neg.	n.d.	n.d.	N/A
892K	Long-eared owl	*Asio otus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
893C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3428 Wiler	BE	Choana	neg.	n.d.	n.d.	N/A
893K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3428 Wiler	BE	Cloaca	neg.	n.d.	n.d.	N/A
894C	Long-eared owl	*Asio otus*	Adult	3251 Wengi	BE	Choana	neg.	n.d.	n.d.	N/A
894K	Long-eared owl	*Asio otus*	Adult	3251 Wengi	BE	Cloaca	neg.	n.d.	n.d.	N/A
895C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
895K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
896C	Common kestrel	*Falco tinnunculus*	Juvenile	3473 Alchenstorf	BE	Choana	neg.	n.d.	n.d.	N/A
896K	Common kestrel	*Falco tinnunculus*	Juvenile	3473 Alchenstorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
897C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
897K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
898C	Common kestrel	*Falco tinnunculus*	Adult	3314 Schalunen	BE	Choana	neg.	n.d.	n.d.	N/A
898K	Common kestrel	*Falco tinnunculus*	Adult	3314 Schalunen	BE	Cloaca	neg.	n.d.	n.d.	N/A
899C	Common kestrel	*Falco tinnunculus*	Adult	3110 Münsingen	BE	Choana	neg.	n.d.	n.d.	N/A
899K	Common kestrel	*Falco tinnunculus*	Adult	3110 Münsingen	BE	Cloaca	neg.	n.d.	n.d.	N/A
900C	Common kestrel	*Falco tinnunculus*	Adult	3365 Seeberg	BE	Choana	neg.	n.d.	n.d.	N/A
900K	Common kestrel	*Falco tinnunculus*	Adult	3365 Seeberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
901C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
901K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
902C	Common kestrel	*Falco tinnunculus*	Adult	3422 Kirchberg	BE	Choana	neg.	n.d.	n.d.	N/A
902K	Common kestrel	*Falco tinnunculus*	Adult	3422 Kirchberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
903C	Common buzzard	*Buteo buteo*	Adult	3006 Bern	BE	Choana	neg.	n.d.	n.d.	N/A
903K	Common buzzard	*Buteo buteo*	Adult	3006 Bern	BE	Cloaca	neg.	n.d.	n.d.	N/A
904C	Barn owl	*Tyto alba*	Adult	3273 Kappelen	BE	Choana	neg.	n.d.	n.d.	N/A
904K	Barn owl	*Tyto alba*	Adult	3273 Kappelen	BE	Cloaca	neg.	n.d.	n.d.	N/A

905C	Common kestrel	*Falco tinnunculus*		5463 Wislikofen	AG	Choana	neg.	n.d.	n.d.	N/A
905K	Common kestrel	*Falco tinnunculus*		5463 Wislikofen	AG	Cloaca	neg.	n.d.	n.d.	N/A
906C	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3400 Burgdorf	BE	Choana	neg.	n.d.	n.d.	N/A
906K	Eurasian sparrowhawk	*Accipiter nisus*	Adult	3400 Burgdorf	BE	Cloaca	neg.	n.d.	n.d.	N/A
907C	Common buzzard	*Buteo buteo*	Adult	3422 Kirchberg	BE	Choana	neg.	n.d.	n.d.	N/A
907K	Common buzzard	*Buteo buteo*	Adult	3422 Kirchberg	BE	Cloaca	neg.	n.d.	n.d.	N/A
908C	Common buzzard	*Buteo buteo*	Adult	4553 Subingen	SO	Choana	neg.	n.d.	n.d.	N/A
908K	Common buzzard	*Buteo buteo*	Adult	4553 Subingen	SO	Cloaca	neg.	n.d.	n.d.	N/A
909C	Red kite	*Milvus milvus*	Adult	3295 Rüti bei Büren	BE	Choana	neg.	n.d.	n.d.	N/A
909K	Red kite	*Milvus milvus*	Adult	3295 Rüti bei Büren	BE	Cloaca	neg.	n.d.	n.d.	N/A
910C	Common buzzard	*Buteo buteo*	Adult			Choana	neg.	n.d.	n.d.	N/A
910K	Common buzzard	*Buteo buteo*	Adult			Cloaca	pos. (41.2)	neg.	neg.	Not identified
911C	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Choana	neg.	n.d.	n.d.	N/A
911K	Eurasian sparrowhawk	*Accipiter nisus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
912C	Common kestrel	*Falco tinnunculus*	Adult			Choana	neg.	n.d.	n.d.	N/A
912K	Common kestrel	*Falco tinnunculus*	Adult			Cloaca	neg.	n.d.	n.d.	N/A
913C	Common buzzard	*Buteo buteo*	Adult	4713 Matzendorf	SO	Choana	neg.	n.d.	n.d.	N/A
913K	Common buzzard	*Buteo buteo*	Adult	4713 Matzendorf	SO	Cloaca	neg.	n.d.	n.d.	N/A
914C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
914K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
926C	Bearded vulture	*Gypaetus barbatus*	Adult	7522 La Punt-Chamues-ch	GR	Choana	neg.	n.d.	n.d.	N/A
926K	Bearded vulture	*Gypaetus barbatus*	Adult	7522 La Punt-Chamues-ch	GR	Cloaca	neg.	n.d.	n.d.	N/A
927C	Golden eagle	*Aquila chrysaetos*	Adult	7463 Surses	GR	Choana	neg.	n.d.	n.d.	N/A
927K	Golden eagle	*Aquila chrysaetos*	Adult	7463 Surses	GR	Cloaca	neg.	n.d.	n.d.	N/A
928C	Golden eagle	*Aquila chrysaetos*	Adult	7165 Breil	GR	Choana	neg.	n.d.	n.d.	N/A
928K	Golden eagle	*Aquila chrysaetos*	Adult	7165 Breil	GR	Cloaca	neg.	n.d.	n.d.	N/A

929K	Golden eagle	*Aquila chrysaetos*	Adult	7156 Pigniu	GR	Cloaca	neg.	n.d.	n.d.	N/A
930C	Golden eagle	*Aquila chrysaetos*	Adult	7608 Castasegna	GR	Choana	neg.	n.d.	n.d.	N/A
930K	Golden eagle	*Aquila chrysaetos*	Adult	7608 Castasegna	GR	Cloaca	neg.	n.d.	n.d.	N/A
931C	Eurasian eagle-owl	*Asio otus*	Adult	7304 Maienfeld	GR	Choana	neg.	n.d.	n.d.	N/A
931K	Eurasian eagle-owl	*Asio otus*	Adult	7304 Maienfeld	GR	Cloaca	neg.	n.d.	n.d.	N/A
932C	Eurasian eagle-owl	*Asio otus*	Adult	6565 Lumbreida San Bernardino	GR	Choana	neg.	n.d.	n.d.	N/A
932K	Eurasian eagle-owl	*Asio otus*	Adult	6565 Lumbreida San Bernardino	GR	Cloaca	neg.	n.d.	n.d.	N/A
933K	Golden eagle	*Aquila chrysaetos*	Adult	6534 San Vittore	GR	Cloaca	neg.	n.d.	n.d.	N/A
934C	Eurasian eagle-owl	*Asio otus*		8752 Näfels	GL	Choana	neg.	n.d.	n.d.	N/A
934K	Eurasian eagle-owl	*Asio otus*		8752 Näfels	GL	Cloaca	neg.	n.d.	n.d.	N/A
935C	Hooded crow	*Corvus cornix*		7130 Ilanz/Glion	GR	Choana	neg.	n.d.	n.d.	N/A
935K	Hooded crow	*Corvus cornix*		7130 Ilanz/Glion	GR	Cloaca	neg.	n.d.	n.d.	N/A
945C	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
945K	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
946C	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
946K	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
947C	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
947K	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
948C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
948K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
949C	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
949K	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
950C	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
950K	Carrion crow	*Corvus corone*	Juvenile	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
951C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
951K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
952C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A

952K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
953C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
953K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
954C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
954K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
955C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
955K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
956C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
956K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
957C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
957K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
958C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
958K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
959C	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Choana	neg.	n.d.	n.d.	N/A
959K	Carrion crow	*Corvus corone*	Adult	1294 Genthod	GE	Cloaca	neg.	n.d.	n.d.	N/A
960C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
960K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
961K	Carrion crow	*Corvus corone*		1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
962C	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
963C	Carrion crow	*Corvus corone*		1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
964C	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
964K	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
965C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
965K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
966C	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
967C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
967K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
968C	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A

968K	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
969C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
969K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
970C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
970K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
971C	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Choana	neg.	n.d.	n.d.	N/A
971K	Carrion crow	*Corvus corone*	Juvenile	1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A
972C	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Choana	pos. (27.5)	neg.	neg.	C. psittaci 1V
972K	Carrion crow	*Corvus corone*	Adult	1786 Sugiez	FR	Cloaca	pos. (36.2)	neg.	neg.	Not identified
973C	Eurasian sparrowhawk	*Accipiter nisus*		6703 Riviera	TI	Choana	neg.	n.d.	n.d.	N/A
973K	Eurasian sparrowhawk	*Accipiter nisus*		6703 Riviera	TI	Cloaca	neg.	n.d.	n.d.	N/A
974C	Eurasian sparrowhawk	*Accipiter nisus*				Choana	neg.	n.d.	n.d.	N/A
974K	Eurasian sparrowhawk	*Accipiter nisus*				Cloaca	neg.	n.d.	n.d.	N/A
975C	Northern goshawk	*Accipiter gentilis*		6702 Claro	TI	Choana	neg.	n.d.	n.d.	N/A
975K	Northern goshawk	*Accipiter gentilis*		6702 Claro	TI	Cloaca	neg.	n.d.	n.d.	N/A
976C	Eurasian sparrowhawk	*Accipiter nisus*		6710 Biasca	TI	Choana	neg.	n.d.	n.d.	N/A
976K	Eurasian sparrowhawk	*Accipiter nisus*		6710 Biasca	TI	Cloaca	neg.	n.d.	n.d.	N/A
977C	Common buzzard	*Buteo buteo*				Choana	neg.	n.d.	n.d.	N/A
977K	Common buzzard	*Buteo buteo*				Cloaca	neg.	n.d.	n.d.	N/A
978C	European Honey-buzzard	*Pernis apivorus*		6514 Sementina	TI	Choana	neg.	n.d.	n.d.	N/A
978K	European Honey-buzzard	*Pernis apivorus*		6514 Sementina	TI	Cloaca	neg.	n.d.	n.d.	N/A
979C	Tawny owl	*Strix aluco*		6760 Faido	TI	Choana	neg.	n.d.	n.d.	N/A
979K	Tawny owl	*Strix aluco*		6760 Faido	TI	Cloaca	neg.	n.d.	n.d.	N/A
980C	Common kestrel	*Falco tinnunculus*		6535 Roveredo	GR	Choana	neg.	n.d.	n.d.	N/A
980K	Common kestrel	*Falco tinnunculus*		6535 Roveredo	GR	Cloaca	neg.	n.d.	n.d.	N/A
981C	Peregrine falcon	*Falco peregrinus*		6512 Giubiasco	TI	Choana	neg.	n.d.	n.d.	N/A
981K	Peregrine falcon	*Falco peregrinus*		6512 Giubiasco	TI	Cloaca	neg.	n.d.	n.d.	N/A

982C	Eurasian jay	*Garrulus glandarius*		3995 Ernen	VS	Choana	neg.	n.d.	n.d.	N/A
982K	Eurasian jay	*Garrulus glandarius*		3995 Ernen	VS	Cloaca	neg.	n.d.	n.d.	N/A
983C	Eurasian jay	*Garrulus glandarius*		3910 Saas Grund	VS	Choana	neg.	n.d.	n.d.	N/A
983K	Eurasian jay	*Garrulus glandarius*		3910 Saas Grund	VS	Cloaca	neg.	n.d.	n.d.	N/A
984K	Golden eagle	*Aquila chrysaetos*	Juvenile	3911 Ried Brig	VS	Cloaca	neg.	n.d.	n.d.	N/A
985C	Northern goshawk	*Accipiter gentilis*		3984 Fiesch	VS	Choana	neg.	n.d.	n.d.	N/A
985K	Northern goshawk	*Accipiter gentilis*		3984 Fiesch	VS	Cloaca	neg.	n.d.	n.d.	N/A
986C	Carrion crow	*Corvus corone*	Juvenile	3995 Ernen	VS	Choana	neg.	n.d.	n.d.	N/A
987C	Eurasian jay	*Garrulus glandarius*		3911 Ried Brig	VS	Choana	neg.	n.d.	n.d.	N/A
987K	Eurasian jay	*Garrulus glandarius*		3911 Ried Brig	VS	Cloaca	neg.	n.d.	n.d.	N/A
988C	Eurasian jay	*Garrulus glandarius*		3911 Ried Brig	VS	Choana	neg.	n.d.	n.d.	N/A
989C	Eurasian sparrowhawk	*Accipiter nisus*		3984 Fiesch	VS	Choana	neg.	n.d.	n.d.	N/A
989K	Eurasian sparrowhawk	*Accipiter nisus*		3984 Fiesch	VS	Cloaca	neg.	n.d.	n.d.	N/A
990C	Carrion crow	*Corvus corone*	Adult	3916 Ferden	VS	Choana	neg.	n.d.	n.d.	N/A
990K	Carrion crow	*Corvus corone*	Adult	3916 Ferden	VS	Cloaca	neg.	n.d.	n.d.	N/A
991C	Eurasian magpie	*Pica pica*		3911 Ried Brig	VS	Choana	neg.	n.d.	n.d.	N/A
991K	Eurasian magpie	*Pica pica*		3911 Ried Brig	VS	Cloaca	neg.	n.d.	n.d.	N/A
992C	Eurasian jay	*Garrulus glandarius*		3995 Ernen	VS	Choana	neg.	n.d.	n.d.	N/A
992K	Eurasian jay	*Garrulus glandarius*		3995 Ernen	VS	Cloaca	neg.	n.d.	n.d.	N/A
993K	Carrion crow	*Corvus corone*		1786 Sugiez	FR	Cloaca	neg.	n.d.	n.d.	N/A

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